FIG. 1

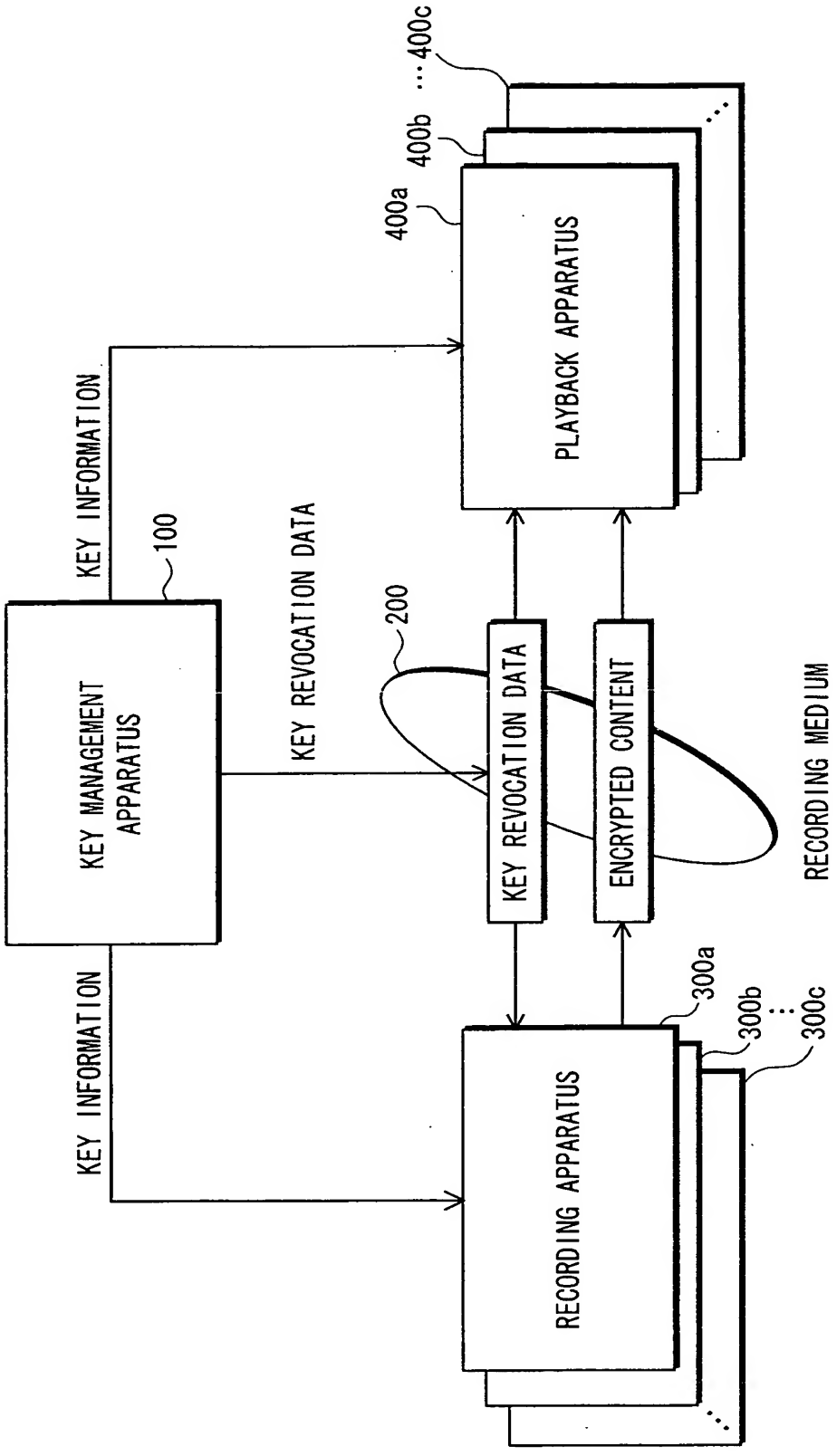

10
KEY INFORMATION
100
KEY MANAGEMENT APPARATUS
KEY REVOCATION DATA
200
KEY REVOCATION DATA
ENCRYPTED CONTENT
RECORDING MEDIUM
KEY INFORMATION
RECORDING APPARATUS
300a
300b
300c
400a
400b
400c
PLAYBACK APPARATUS

FIG. 2

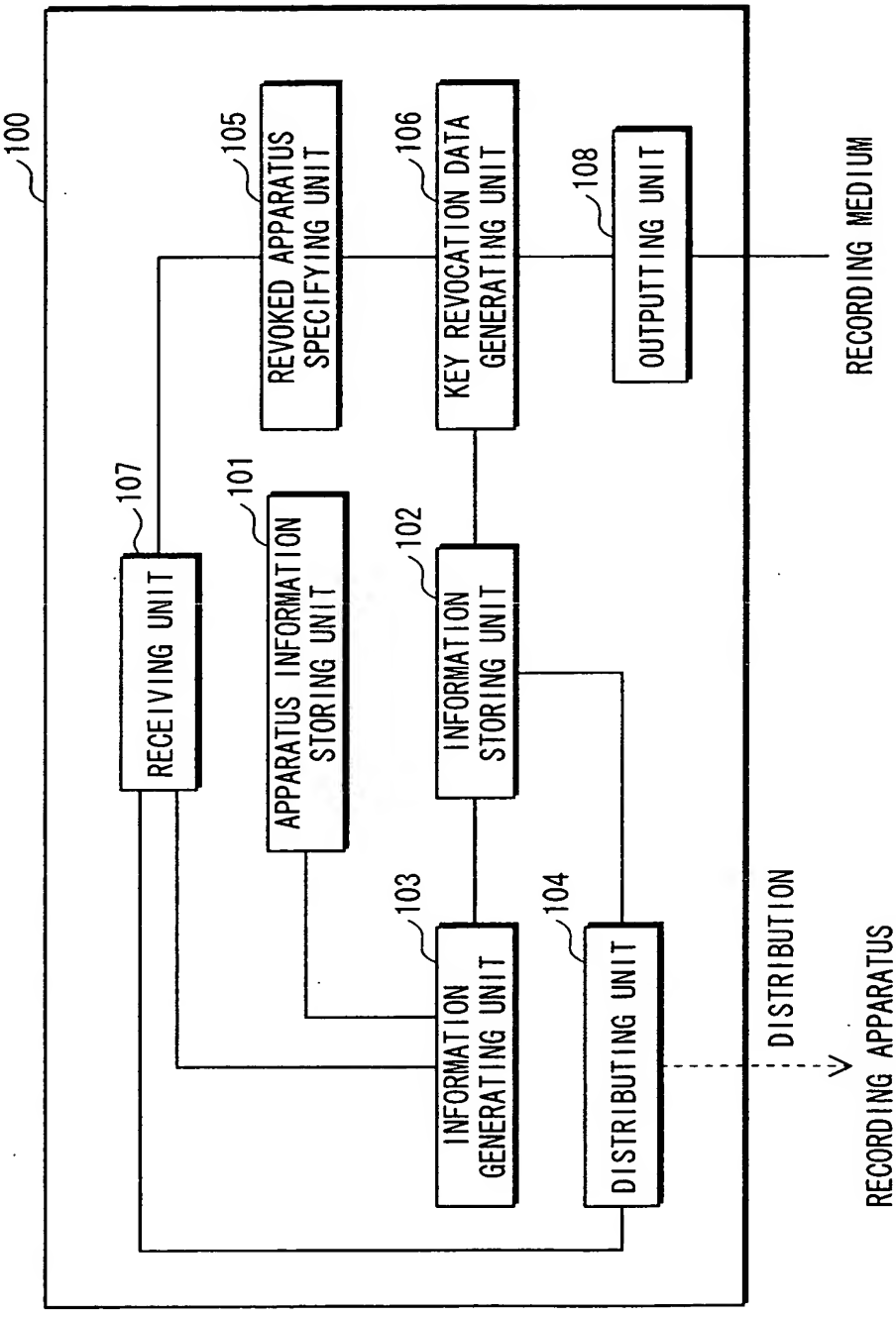

100
105
REVOKED APPARATUS SPECIFYING UNIT
106
KEY REVOCATION DATA GENERATING UNIT
108
OUTPUTTING UNIT
RECORDING MEDIUM
107
RECEIVING UNIT
101
APPARATUS INFORMATION STORING UNIT
102
INFORMATION STORING UNIT
103
INFORMATION GENERATING UNIT
104
DISTRIBUTING UNIT
DISTRIBUTION
RECORDING APPARATUS
PLAYBACK APPARATUS

FIG. 3

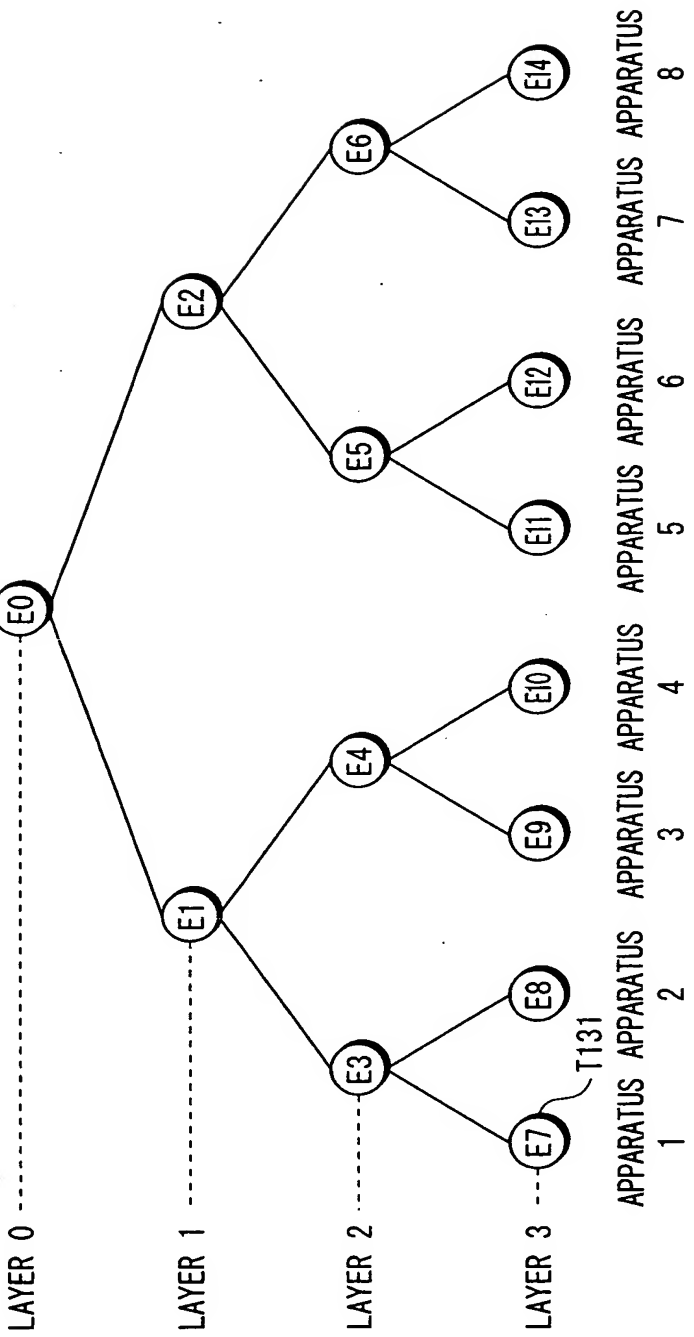
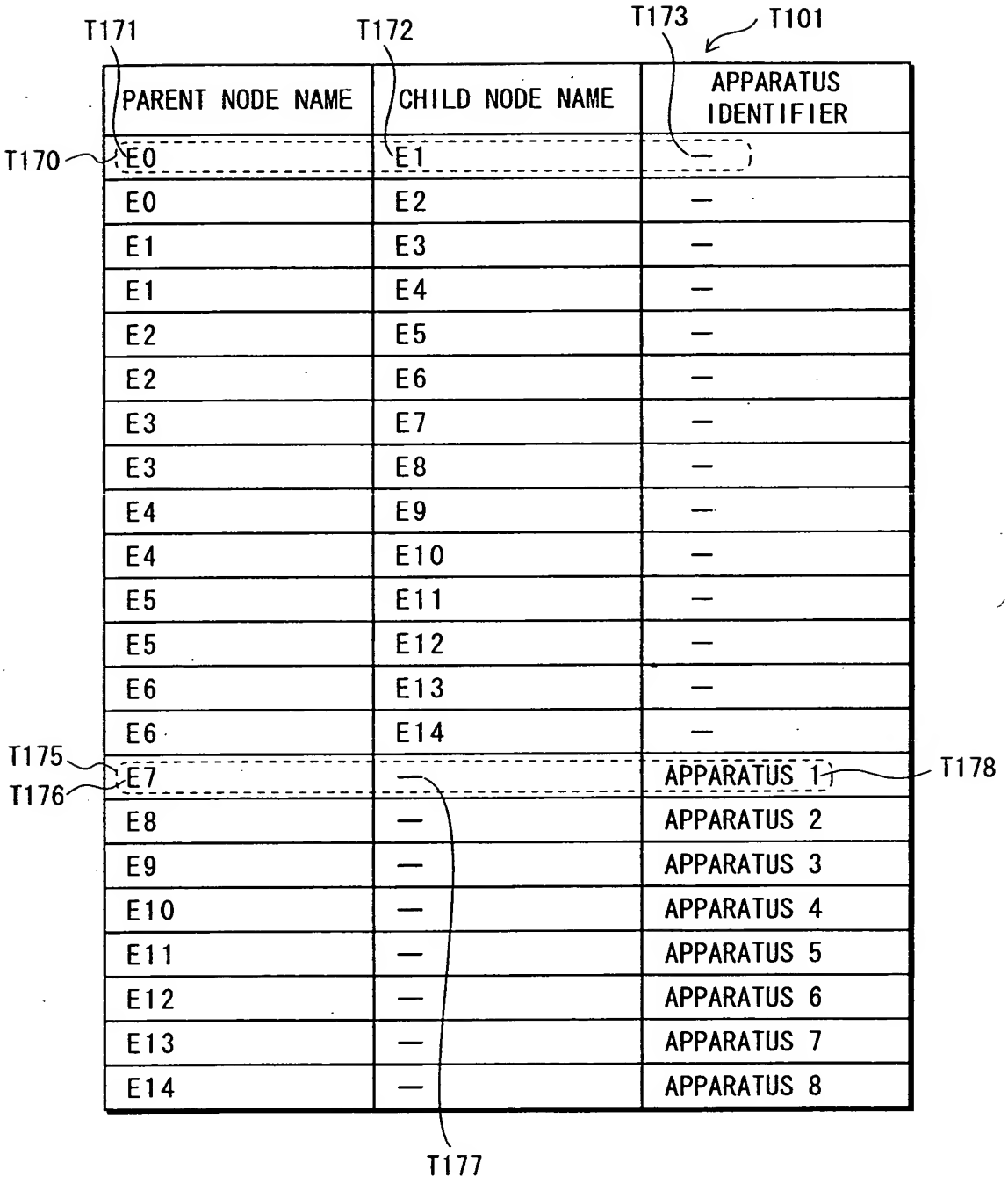

T100
T130
E0
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
E11
E12
E13
E14
T131
LAYER 0
LAYER 1
LAYER 2
LAYER 3
APPARATUS 1
APPARATUS 2
APPARATUS 3
APPARATUS 4
APPARATUS 5
APPARATUS 6
APPARATUS 7
APPARATUS 8

FIG. 4



PARENT NODE NAME	CHILD NODE NAME	APPARATUS IDENTIFIER
E0	E1	—
E0	E2	—
E1	E3	—
E1	E4	—
E2	E5	—
E2	E6	—
E3	E7	—
E3	E8	—
E4	E9	—
E4	E10	—
E5	E11	—
E5	E12	—
E6	E13	—
E6	E14	—
E7	—	APPARATUS 1
E8	—	APPARATUS 2
E9	—	APPARATUS 3
E10	—	APPARATUS 4
E11	—	APPARATUS 5
E12	—	APPARATUS 6
E13	—	APPARATUS 7
E14	—	APPARATUS 8

FIG. 5

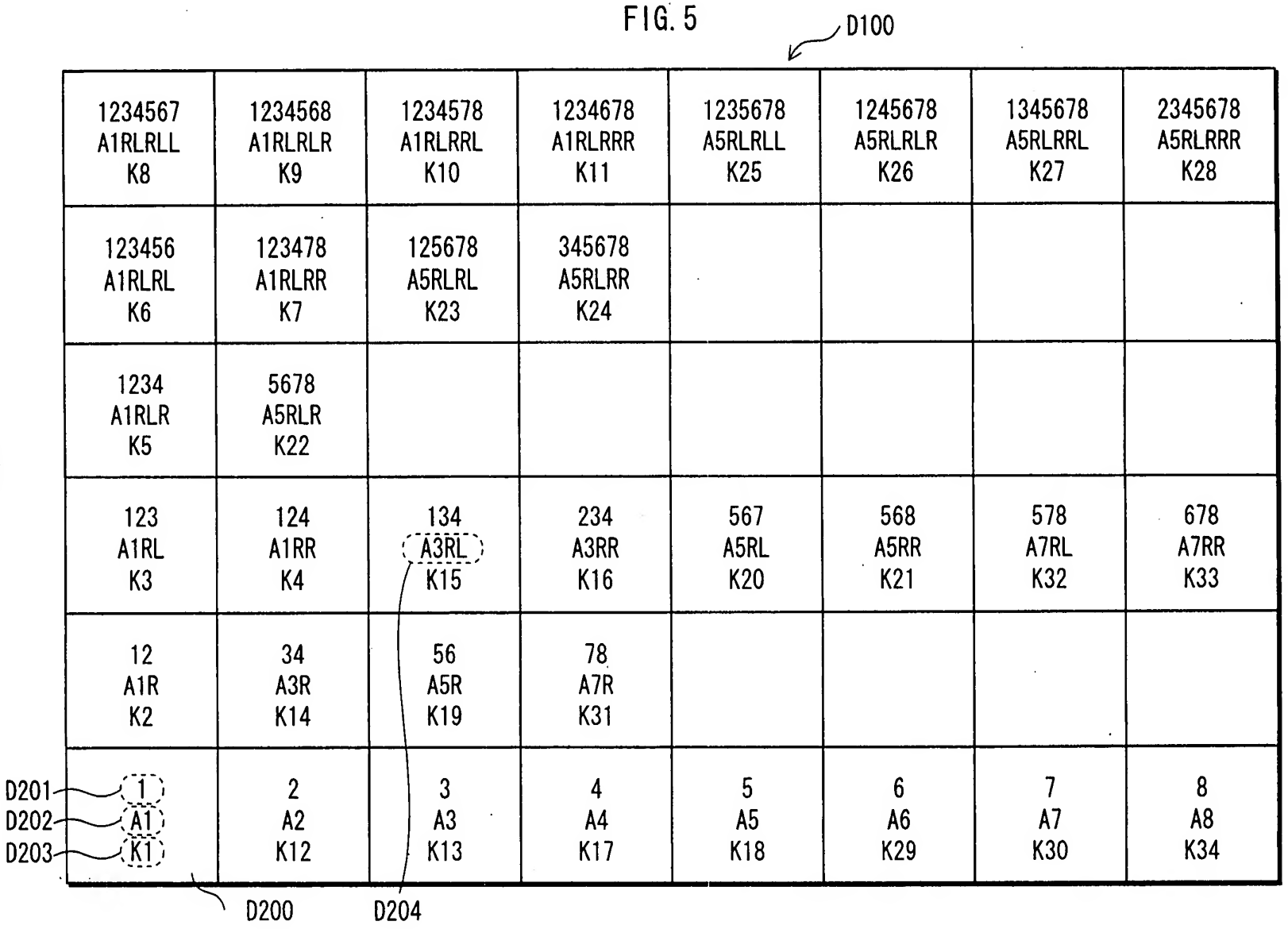

D100
1234567 A1RLRLL K8
1234568 A1RLRLR K9
1234578 A1RLRRL K10
1234678 A1RLRRR K11
1235678 A5RLRLL K25
1245678 A5RLRLR K26
1345678 A5RLRRL K27
2345678 A5RLRRR K28
123456 A1RLRL K6
123478 A1RLRR K7
125678 A5RLRL K23
345678 A5RLRR K24
1234 A1RLR K5
5678 A5RLR K22
123 A1RL K3
124 A1RR K4
134 A3RL K15
234 A3RR K16
567 A5RL K20
568 A5RR K21
578 A7RL K32
678 A7RR K33
12 A1R K2
34 A3R K14
56 A5R K19
78 A7R K31
D201
D202
D203
1
A1
K1
2 A2 K12
3 A3 K13
4 A4 K17
5 A5 K18
6 A6 K29
7 A7 K30
8 A8 K34
D200
D204

FIG. 6

D101

	PARENT NODE	CHILD NODE	ROOT INFORMATION	
D301	1	12	ROOT	D300
	12	123		
	12	124		
	123	1234		
D302	124	—		
	1234	123456		
	1234	123478		
	123456	1234567		
	123456	1234568		
	123478	1234578		
	123478	1234678		
D303	1234567	—		
	1234568	—		
	1234578	—		
	1234678	—		
D311	2	—	ROOT	D310
	3	34	ROOT	D320
	34	134		
	34	234		
D321	134	—		
D322	234	—		
D331	4	—	ROOT	D330
	5	56	ROOT	
	56	567		
	56	568		
	567	5678		
	568	—		
	5678	125678		
	5678	345678		
	125678	1235678		
	125678	1245678		
	345678	1345678		
	345678	2345678		
	1235678	—		
	1245678	—		
	1345678	—		
	2345678	—		
	6	—	ROOT	
	7	78	ROOT	
	78	578		
	78	678		
	578	—		
	678	—		
	8	—	ROOT	

FIG. 7

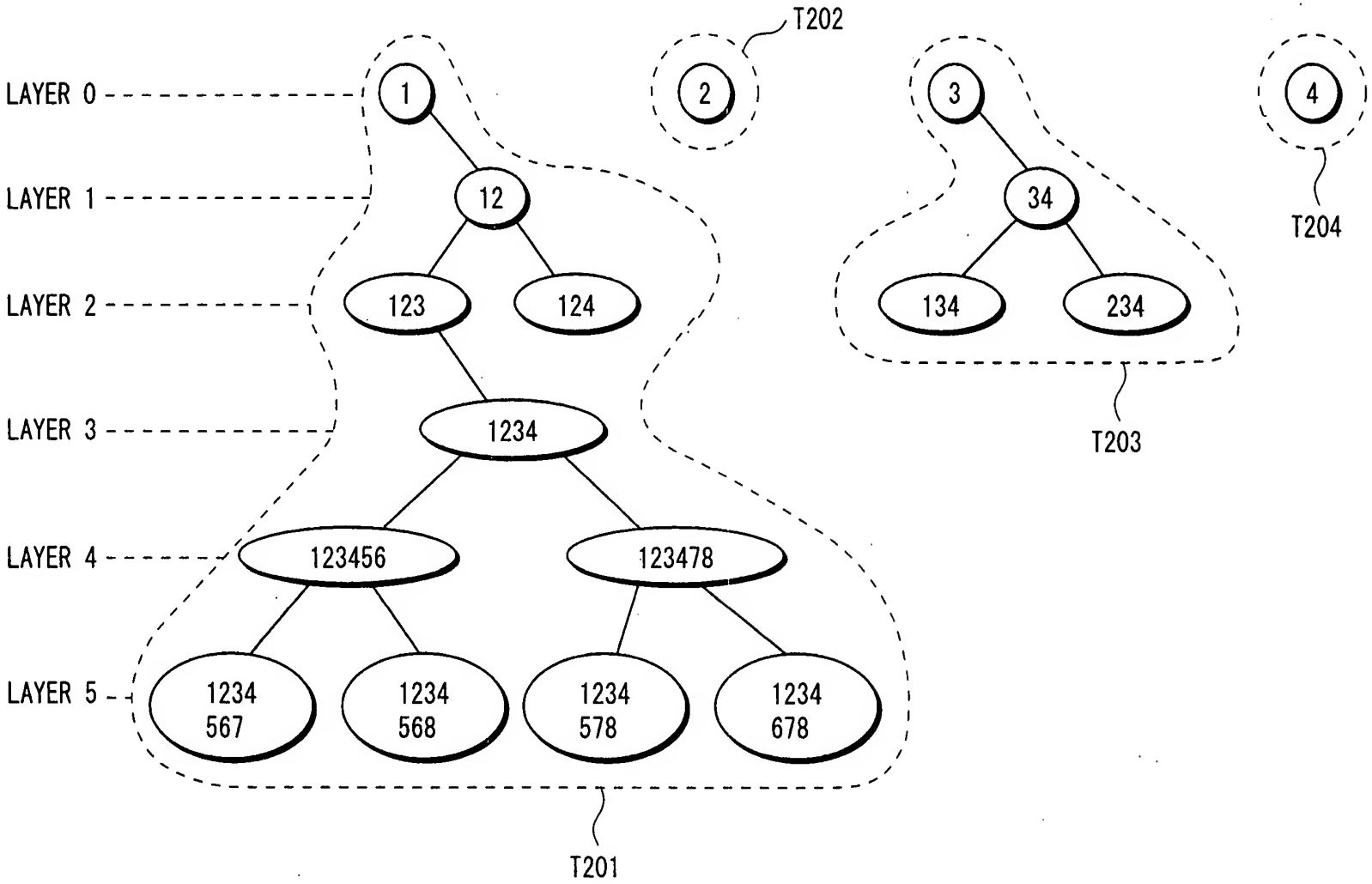

LAYER 0
LAYER 1
LAYER 2
LAYER 3
LAYER 4
LAYER 5
1
2
3
4
12
34
123
124
134
234
1234
123456
123478
1234 567
1234 568
1234 578
1234 678
T201
T202
T203
T204

FIG. 8

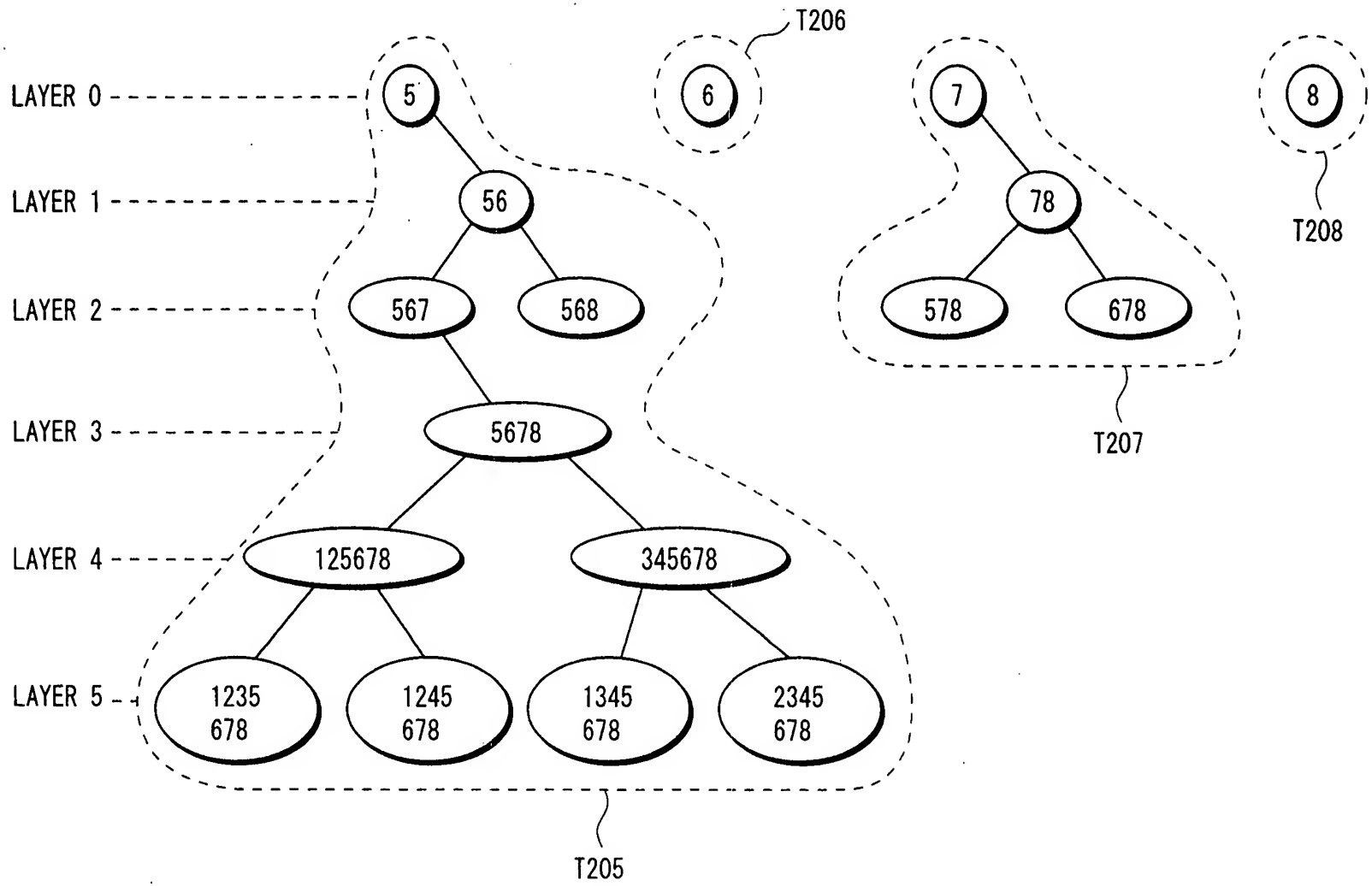

LAYER 0
LAYER 1
LAYER 2
LAYER 3
LAYER 4
LAYER 5
5
56
567
568
5678
125678
345678
1235
678
1245
678
1345
678
2345
678
T205
6
T206
7
78
578
678
T207
8
T208

FIG. 9

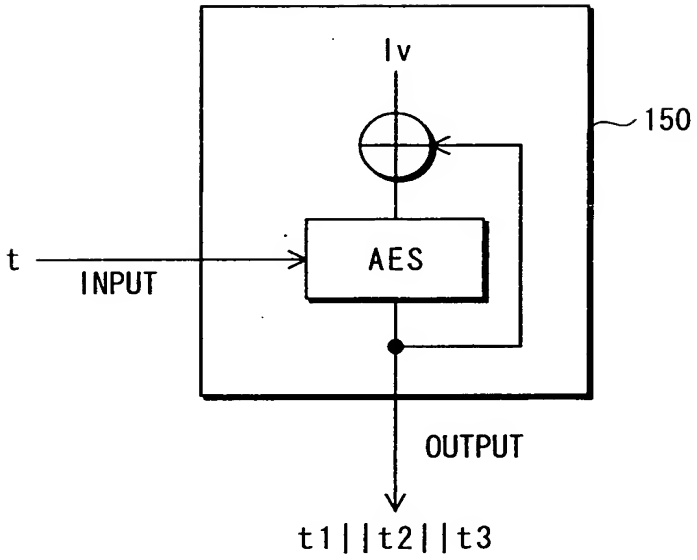


FIG. 10

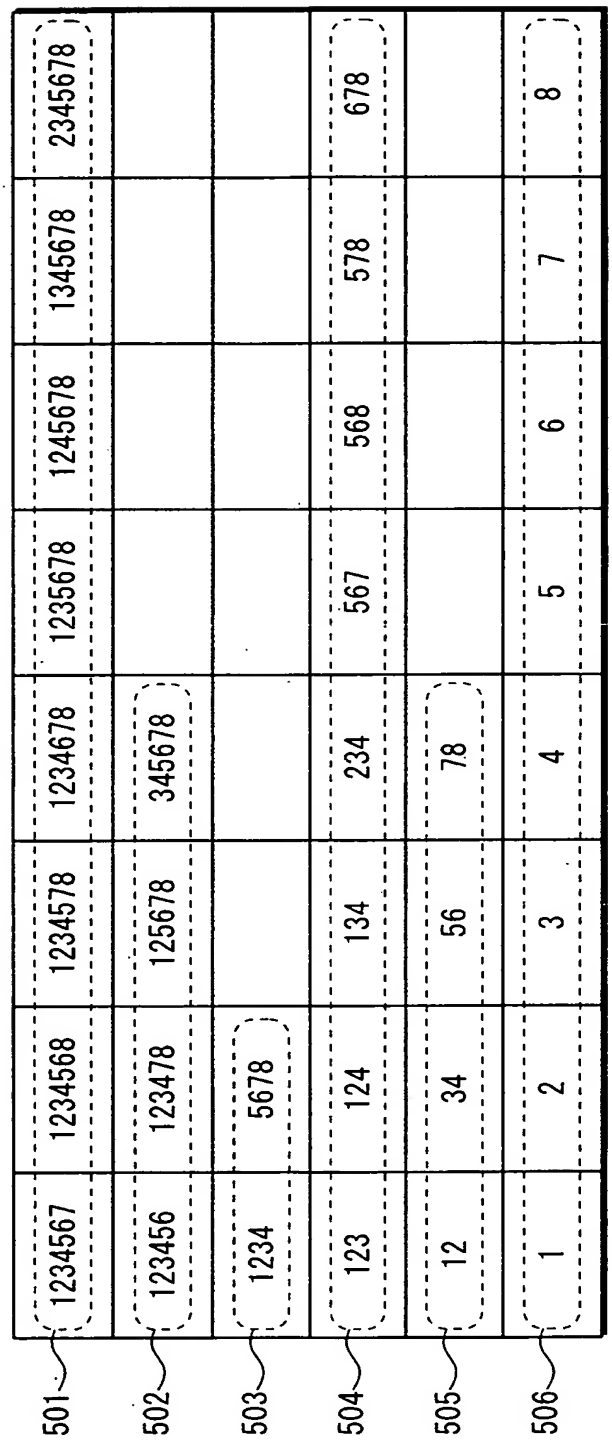

D100a
1234567
1234568
1234578
1234678
1235678
1245678
1345678
2345678
123456
123478
125678
345678
1234
5678
123
124
134
234
567
568
578
678
12
34
56
78
1
2
3
4
5
6
7
8
501
502
503
504
505
506

FIG. 11

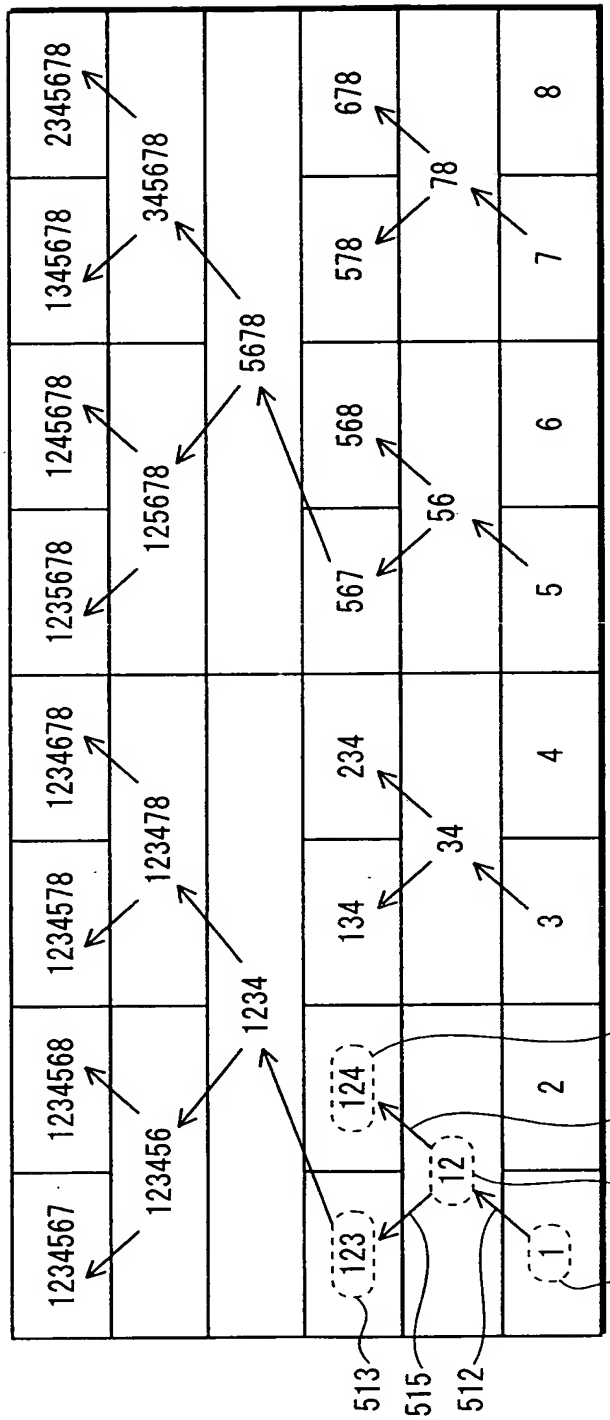
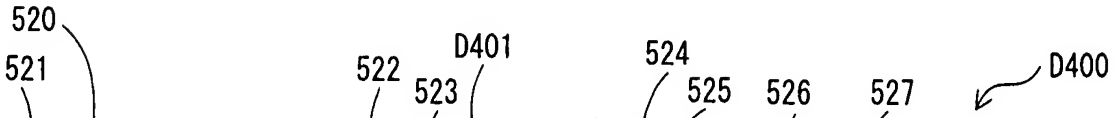

1234567
123456
1234568
1234578
123478
1234678
1235678
125678
1245678
1345678
345678
2345678
123
1234
124
134
234
1235678
567
5678
1245678
568
56
1345678
578
78
2345678
678
8
1
12
123
124
2
3
4
5
6
7
8
34
510
511
512
513
514
515
516

FIG. 12



APPARATUS NAME	TOTAL NUMBER OF PIECES	KEY INFORMATION STORED IN THE APPARATUS					
APPARATUS 1	4 PIECES (−2)	1 A1	134 A3RL	125678 A5RLRL	1345678 A5RLRRL		
APPARATUS 2	5 PIECES (−1)	2 A2	12 A1R	234 A3RR	125678 A5RLRL	2345678 A5RLRRR	
APPARATUS 3	4 PIECES (−2)	3 A3	123 A1RL	345678 A5RLRR	1235678 A5RLRLL		
APPARATUS 4	6 PIECES (0)	4 A4	34 A3R	124 A1RR	1234 A1RLR	345678 A5RLRR	1245678 A5RLRLR
APPARATUS 5	4 PIECES (−2)	5 A5	578 A7RL	123456 A1RLRL	1234578 A1RLRRL		
APPARATUS 6	5 PIECES (−1)	6 A6	56 A5R	678 A7RR	123456 A1RLRL	1234678 A1RLRRR	
APPARATUS 7	4 PIECES (−2)	7 A7	567 A5RL	123478 A1RLRR	1234567 A1RLRLL		
APPARATUS 8	6 PIECES (0)	8 A8	78 A7R	568 A5RR	5678 A5RLR	123478 A1RLRR	1234568 A1RLRLR

FIG. 13

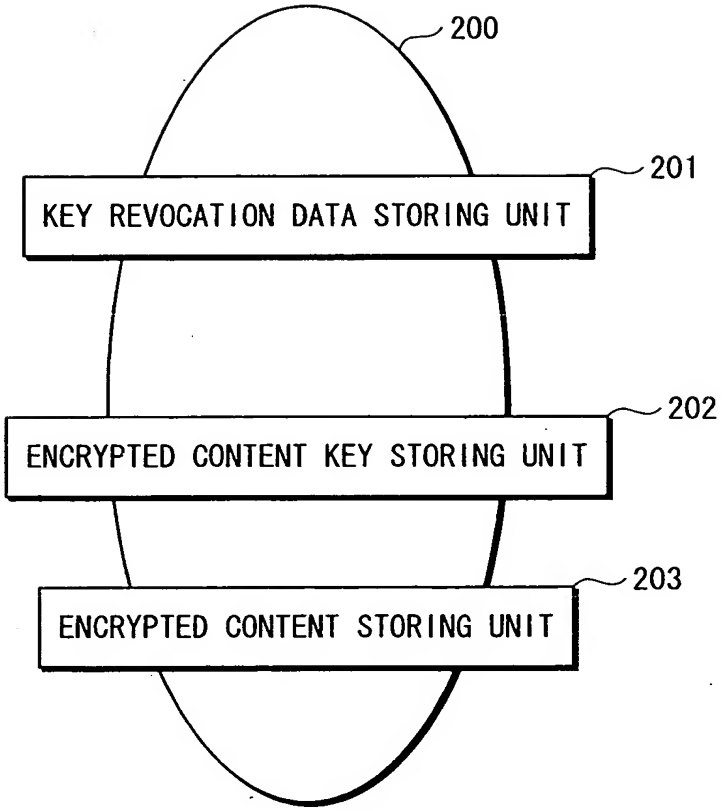

200
201
KEY REVOCATION DATA STORING UNIT
202
ENCRYPTED CONTENT KEY STORING UNIT
203
ENCRYPTED CONTENT STORING UNIT

FIG. 14

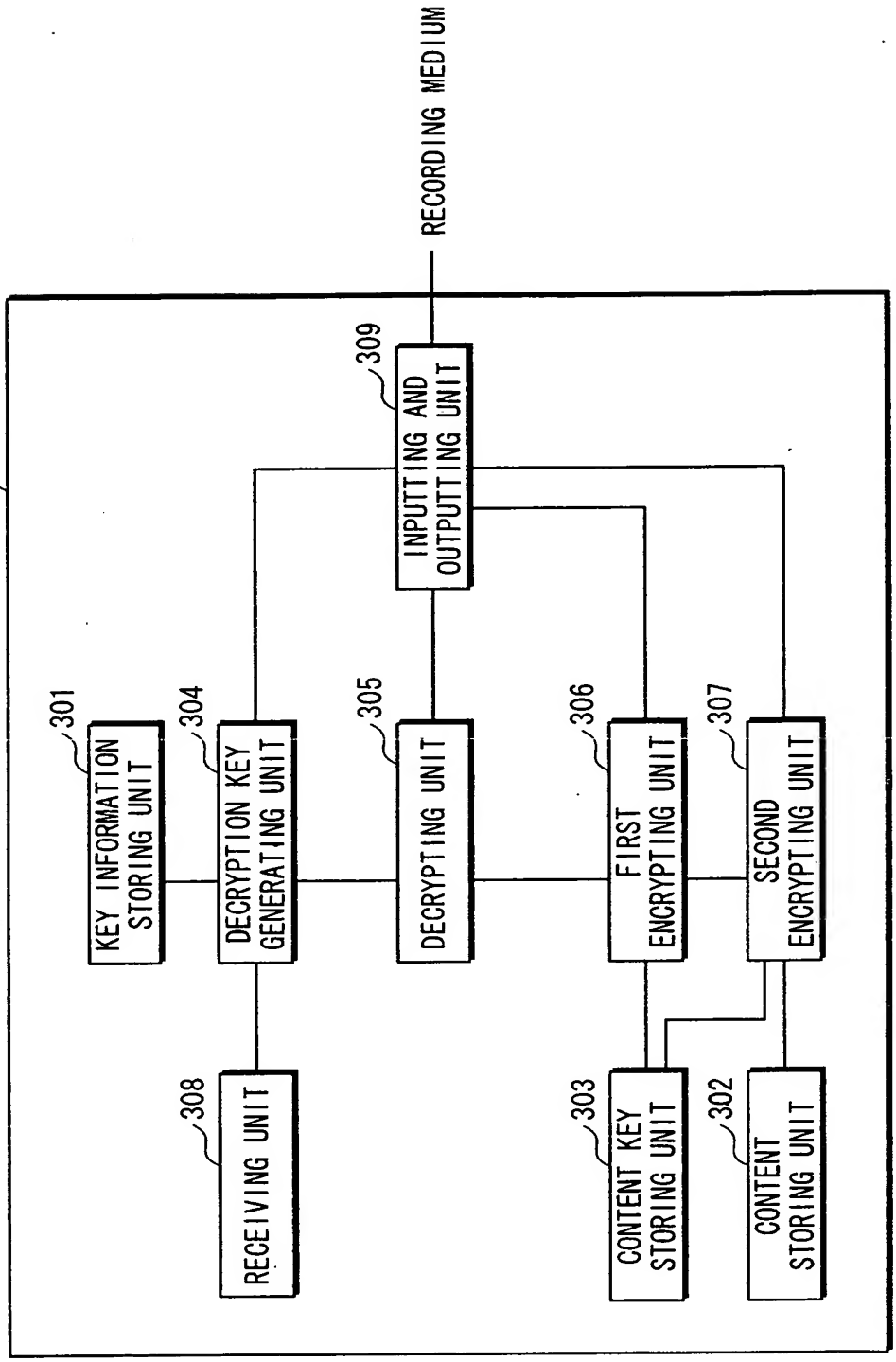

RECORDING MEDIUM
300
309
INPUTTING AND OUTPUTTING UNIT
301
KEY INFORMATION STORING UNIT
304
DECRYPTION KEY GENERATING UNIT
305
DECRYPTING UNIT
306
FIRST ENCRYPTING UNIT
307
SECOND ENCRYPTING UNIT
308
RECEIVING UNIT
303
CONTENT KEY STORING UNIT
302
CONTENT STORING UNIT

FIG. 15

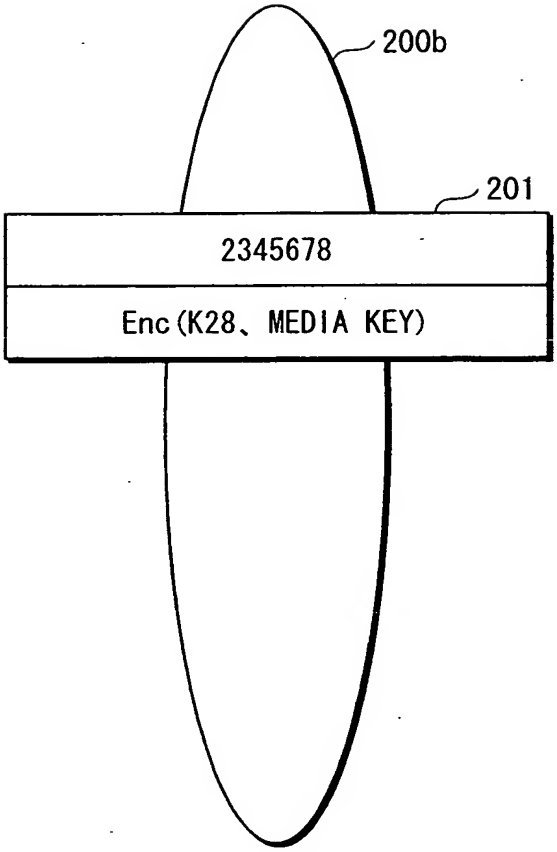


FIG. 16

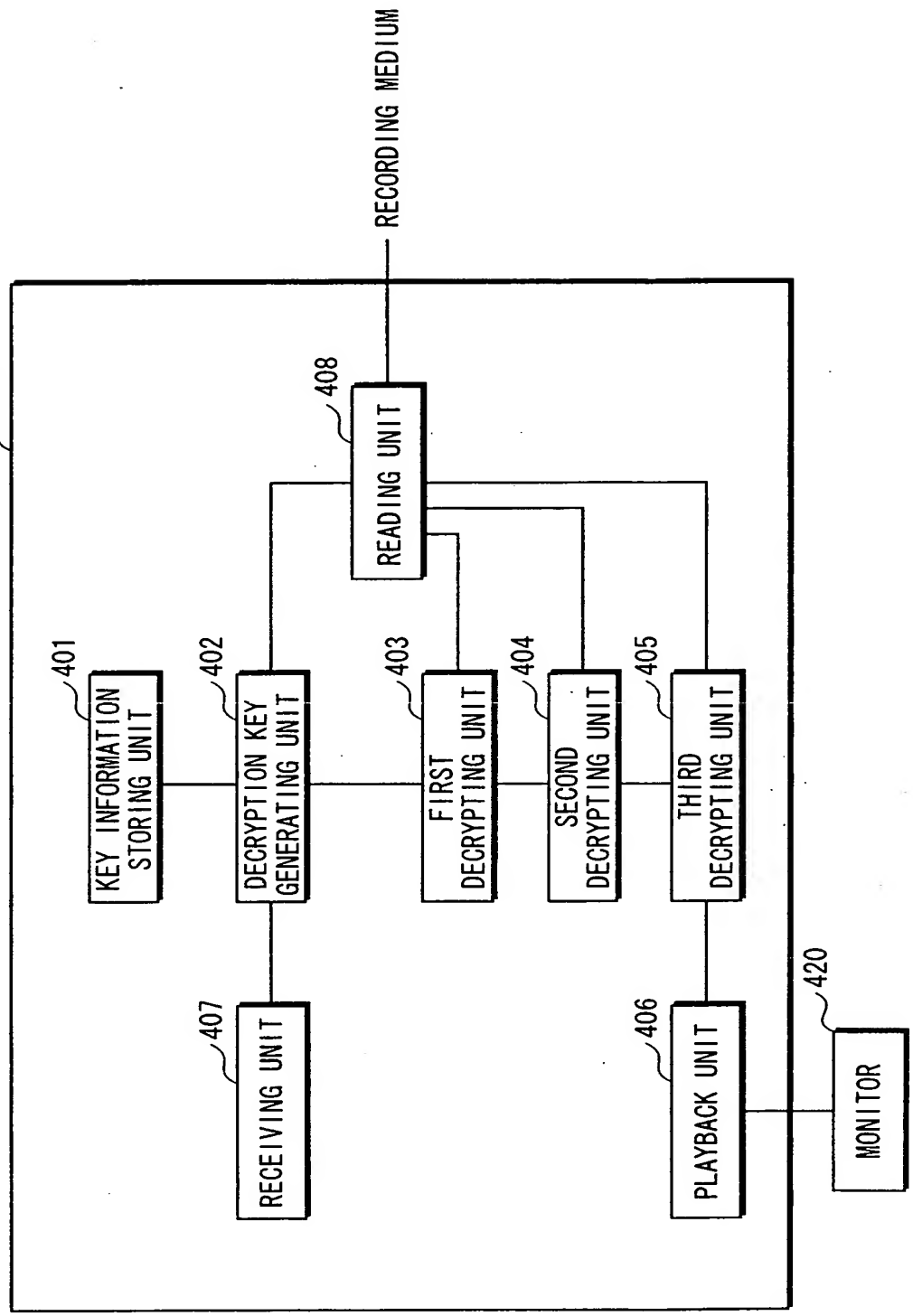

RECORDING MEDIUM
400
408
READING UNIT
401
KEY INFORMATION STORING UNIT
402
DECRYPTION KEY GENERATING UNIT
403
FIRST DECRYPTING UNIT
404
SECOND DECRYPTING UNIT
405
THIRD DECRYPTING UNIT
407
RECEIVING UNIT
406
PLAYBACK UNIT
420
MONITOR

FIG. 17

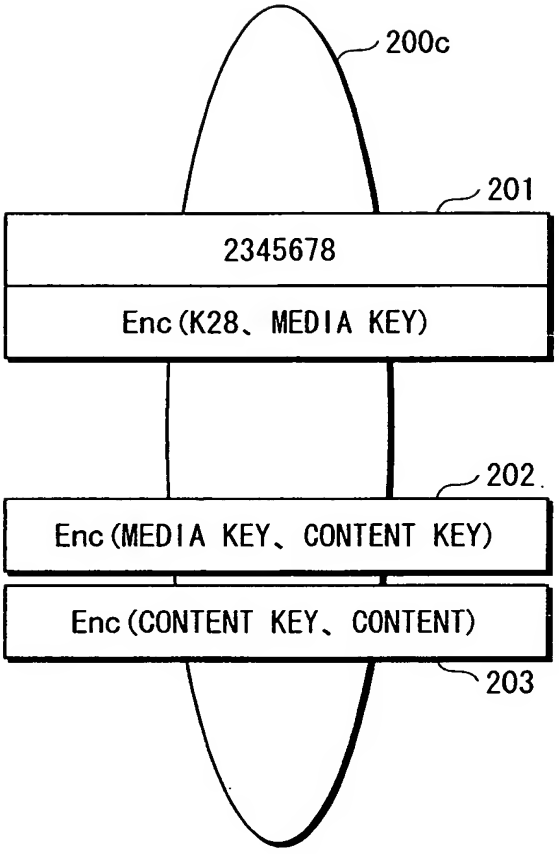

200c
201
2345678
Enc(K28、MEDIA KEY)
202
Enc(MEDIA KEY、CONTENT KEY)
Enc(CONTENT KEY、CONTENT)
203

FIG. 18

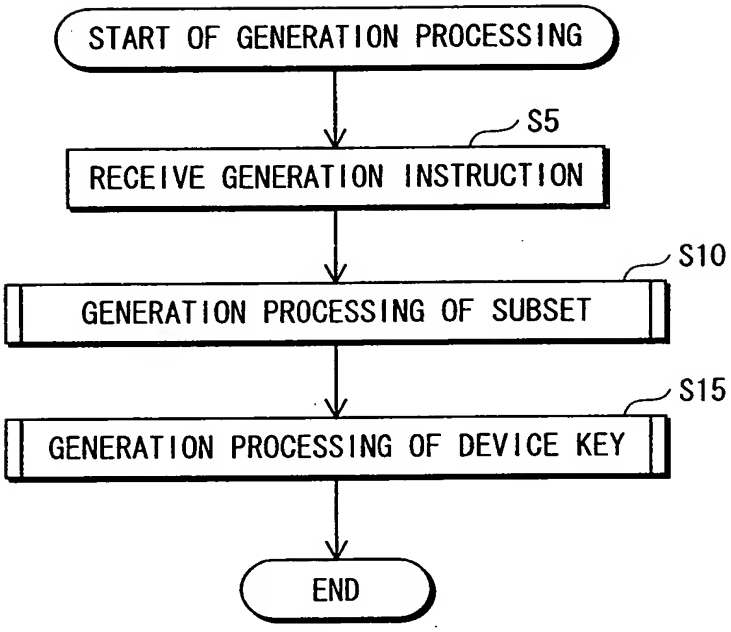

START OF GENERATION PROCESSING
S5
RECEIVE GENERATION INSTRUCTION
S10
GENERATION PROCESSING OF SUBSET
S15
GENERATION PROCESSING OF DEVICE KEY
END

FIG. 19

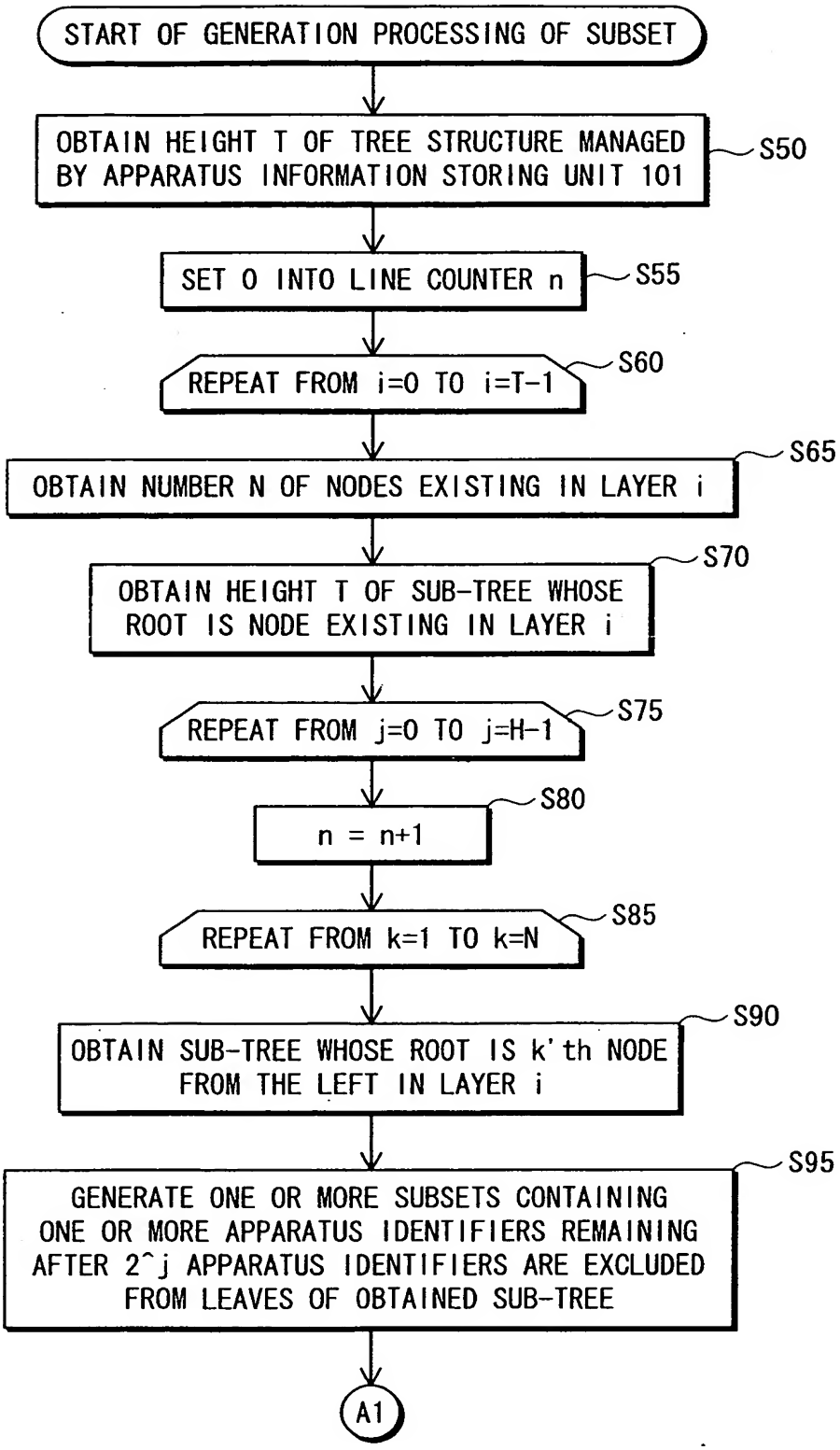

START OF GENERATION PROCESSING OF SUBSET
OBTAIN HEIGHT T OF TREE STRUCTURE MANAGED BY APPARATUS INFORMATION STORING UNIT 101
S50
SET 0 INTO LINE COUNTER n
S55
REPEAT FROM i=0 TO i=T-1
S60
OBTAIN NUMBER N OF NODES EXISTING IN LAYER i
S65
OBTAIN HEIGHT T OF SUB-TREE WHOSE ROOT IS NODE EXISTING IN LAYER i
S70
REPEAT FROM j=0 TO j=H-1
S75
n = n+1
S80
REPEAT FROM k=1 TO k=N
S85
OBTAIN SUB-TREE WHOSE ROOT IS k'th NODE FROM THE LEFT IN LAYER i
S90
GENERATE ONE OR MORE SUBSETS CONTAINING ONE OR MORE APPARATUS IDENTIFIERS REMAINING AFTER 2^j APPARATUS IDENTIFIERS ARE EXCLUDED FROM LEAVES OF OBTAINED SUB-TREE
S95
A1

FIG. 20

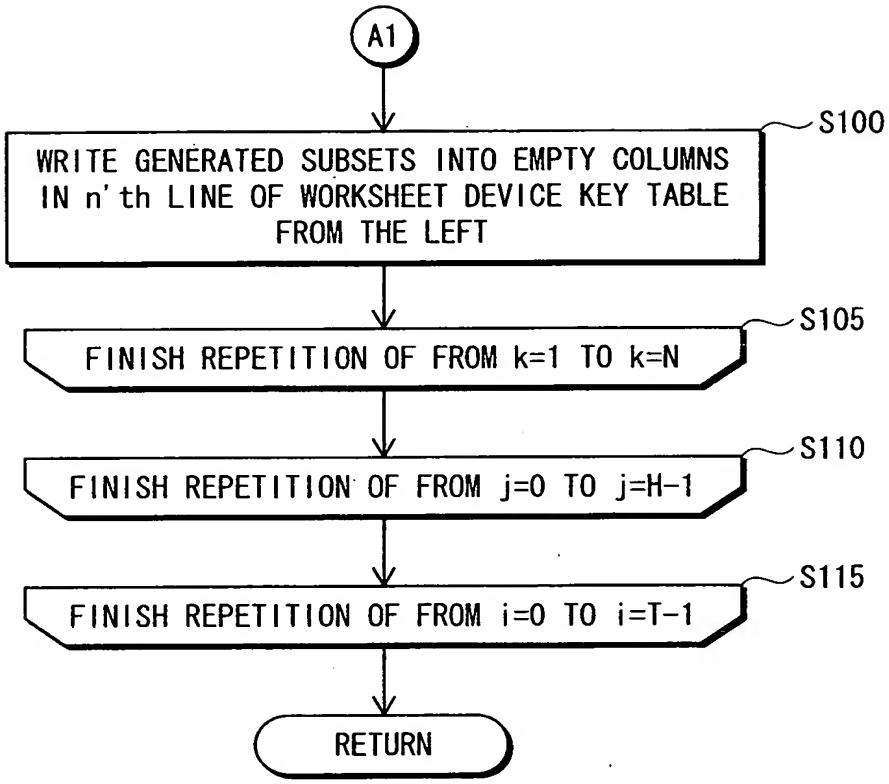

A1
WRITE GENERATED SUBSETS INTO EMPTY COLUMNS IN n'th LINE OF WORKSHEET DEVICE KEY TABLE FROM THE LEFT
S100
FINISH REPETITION OF FROM k=1 TO k=N
S105
FINISH REPETITION OF FROM j=0 TO j=H-1
S110
FINISH REPETITION OF FROM i=0 TO i=T-1
S115
RETURN

FIG. 21

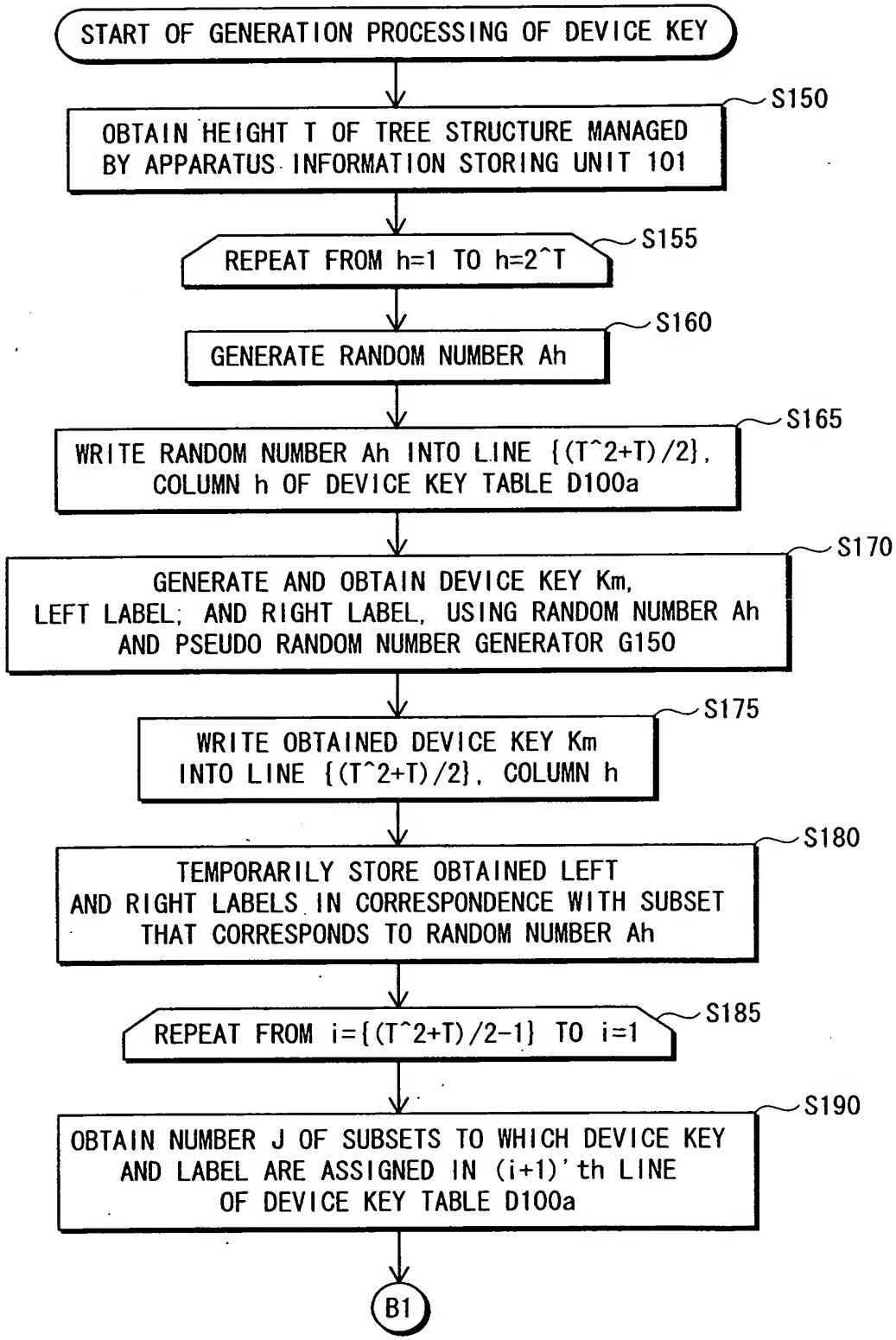

START OF GENERATION PROCESSING OF DEVICE KEY
S150
OBTAIN HEIGHT T OF TREE STRUCTURE MANAGED BY APPARATUS INFORMATION STORING UNIT 101
S155
REPEAT FROM h=1 TO h=2^T
S160
GENERATE RANDOM NUMBER Ah
S165
WRITE RANDOM NUMBER Ah INTO LINE {(T^2+T)/2}, COLUMN h OF DEVICE KEY TABLE D100a
S170
GENERATE AND OBTAIN DEVICE KEY Km, LEFT LABEL, AND RIGHT LABEL, USING RANDOM NUMBER Ah AND PSEUDO RANDOM NUMBER GENERATOR G150
S175
WRITE OBTAINED DEVICE KEY Km INTO LINE {(T^2+T)/2}, COLUMN h
S180
TEMPORARILY STORE OBTAINED LEFT AND RIGHT LABELS IN CORRESPONDENCE WITH SUBSET THAT CORRESPONDS TO RANDOM NUMBER Ah
S185
REPEAT FROM i={(T^2+T)/2-1} TO i=1
S190
OBTAIN NUMBER J OF SUBSETS TO WHICH DEVICE KEY AND LABEL ARE ASSIGNED IN (i+1)'th LINE OF DEVICE KEY TABLE D100a
B1

FIG. 22

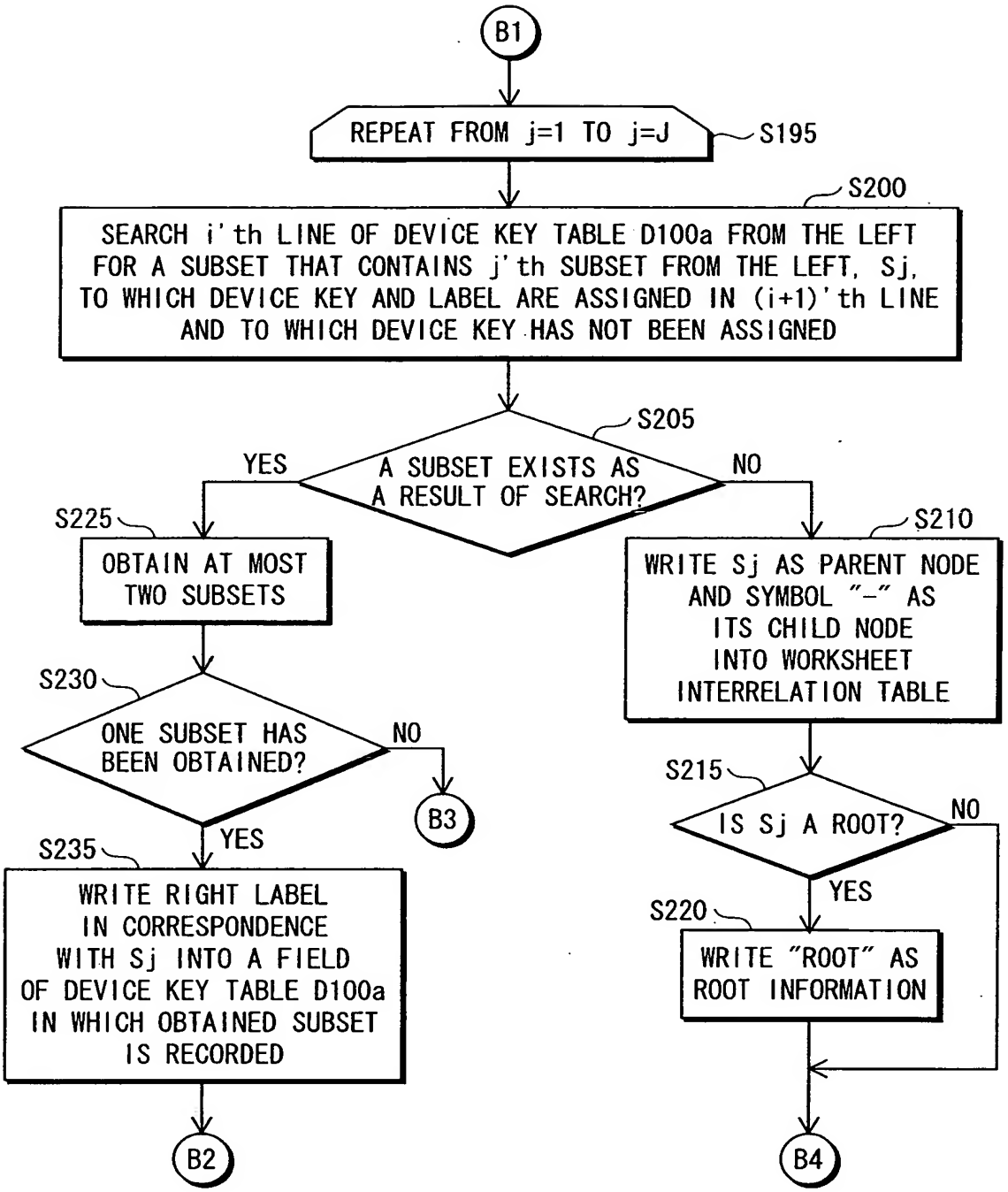

B1
REPEAT FROM j=1 TO j=J
S195
S200
SEARCH i'th LINE OF DEVICE KEY TABLE D100a FROM THE LEFT FOR A SUBSET THAT CONTAINS j'th SUBSET FROM THE LEFT, Sj, TO WHICH DEVICE KEY AND LABEL ARE ASSIGNED IN (i+1)'th LINE AND TO WHICH DEVICE KEY HAS NOT BEEN ASSIGNED
S205
A SUBSET EXISTS AS A RESULT OF SEARCH?
YES
NO
S225
OBTAIN AT MOST TWO SUBSETS
S230
ONE SUBSET HAS BEEN OBTAINED?
NO
B3
YES
S235
WRITE RIGHT LABEL IN CORRESPONDENCE WITH Sj INTO A FIELD OF DEVICE KEY TABLE D100a IN WHICH OBTAINED SUBSET IS RECORDED
B2
S210
WRITE Sj AS PARENT NODE AND SYMBOL "-" AS ITS CHILD NODE INTO WORKSHEET INTERRELATION TABLE
S215
IS Sj A ROOT?
NO
YES
S220
WRITE "ROOT" AS ROOT INFORMATION
B4

FIG. 23

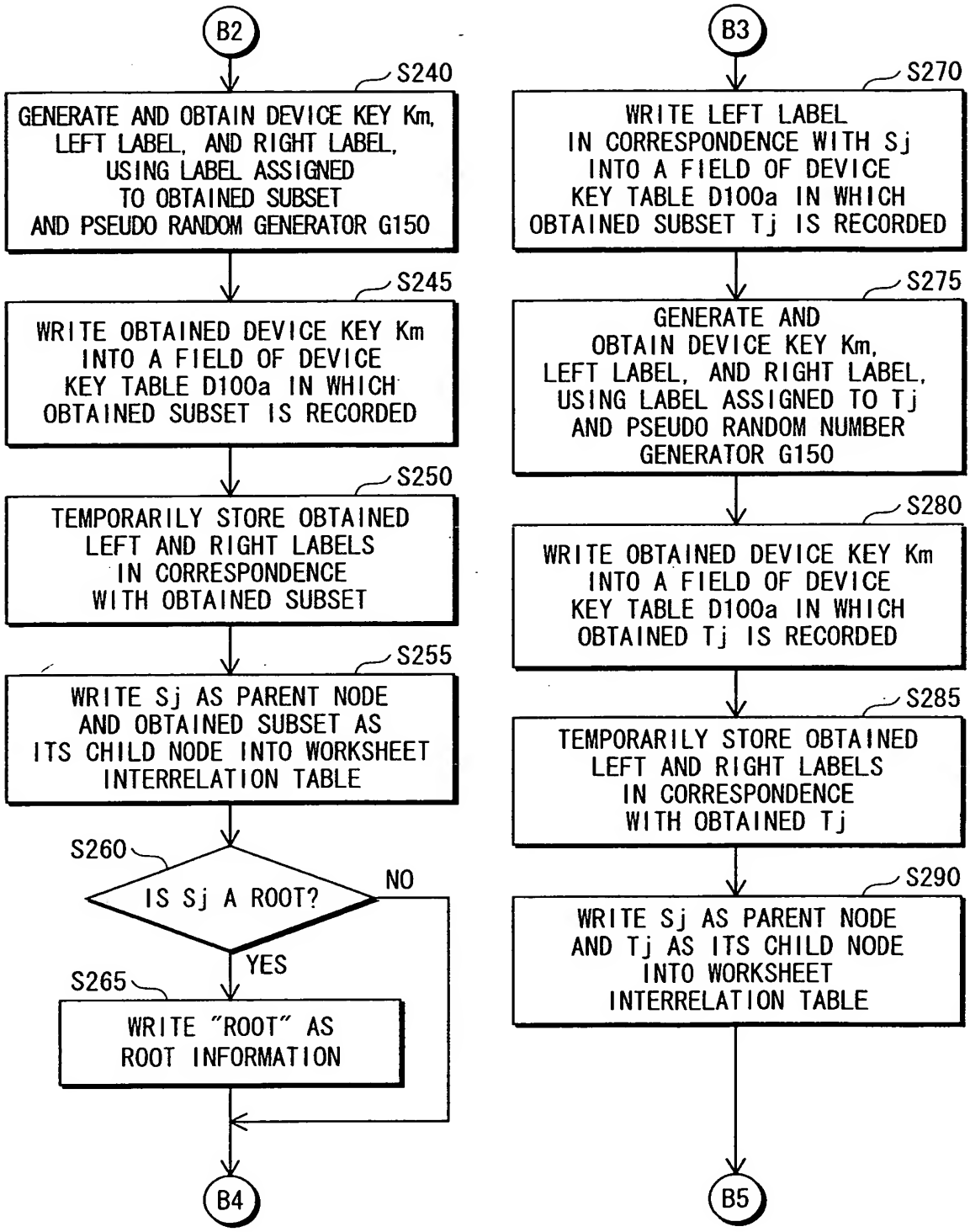

B2
S240
GENERATE AND OBTAIN DEVICE KEY Km, LEFT LABEL, AND RIGHT LABEL, USING LABEL ASSIGNED TO OBTAINED SUBSET AND PSEUDO RANDOM GENERATOR G150
S245
WRITE OBTAINED DEVICE KEY Km INTO A FIELD OF DEVICE KEY TABLE D100a IN WHICH OBTAINED SUBSET IS RECORDED
S250
TEMPORARILY STORE OBTAINED LEFT AND RIGHT LABELS IN CORRESPONDENCE WITH OBTAINED SUBSET
S255
WRITE Sj AS PARENT NODE AND OBTAINED SUBSET AS ITS CHILD NODE INTO WORKSHEET INTERRELATION TABLE
S260
IS Sj A ROOT?
NO
YES
S265
WRITE "ROOT" AS ROOT INFORMATION
B4
B3
S270
WRITE LEFT LABEL IN CORRESPONDENCE WITH Sj INTO A FIELD OF DEVICE KEY TABLE D100a IN WHICH OBTAINED SUBSET Tj IS RECORDED
S275
GENERATE AND OBTAIN DEVICE KEY Km, LEFT LABEL, AND RIGHT LABEL, USING LABEL ASSIGNED TO Tj AND PSEUDO RANDOM NUMBER GENERATOR G150
S280
WRITE OBTAINED DEVICE KEY Km INTO A FIELD OF DEVICE KEY TABLE D100a IN WHICH OBTAINED Tj IS RECORDED
S285
TEMPORARILY STORE OBTAINED LEFT AND RIGHT LABELS IN CORRESPONDENCE WITH OBTAINED Tj
S290
WRITE Sj AS PARENT NODE AND Tj AS ITS CHILD NODE INTO WORKSHEET INTERRELATION TABLE
B5

FIG. 24

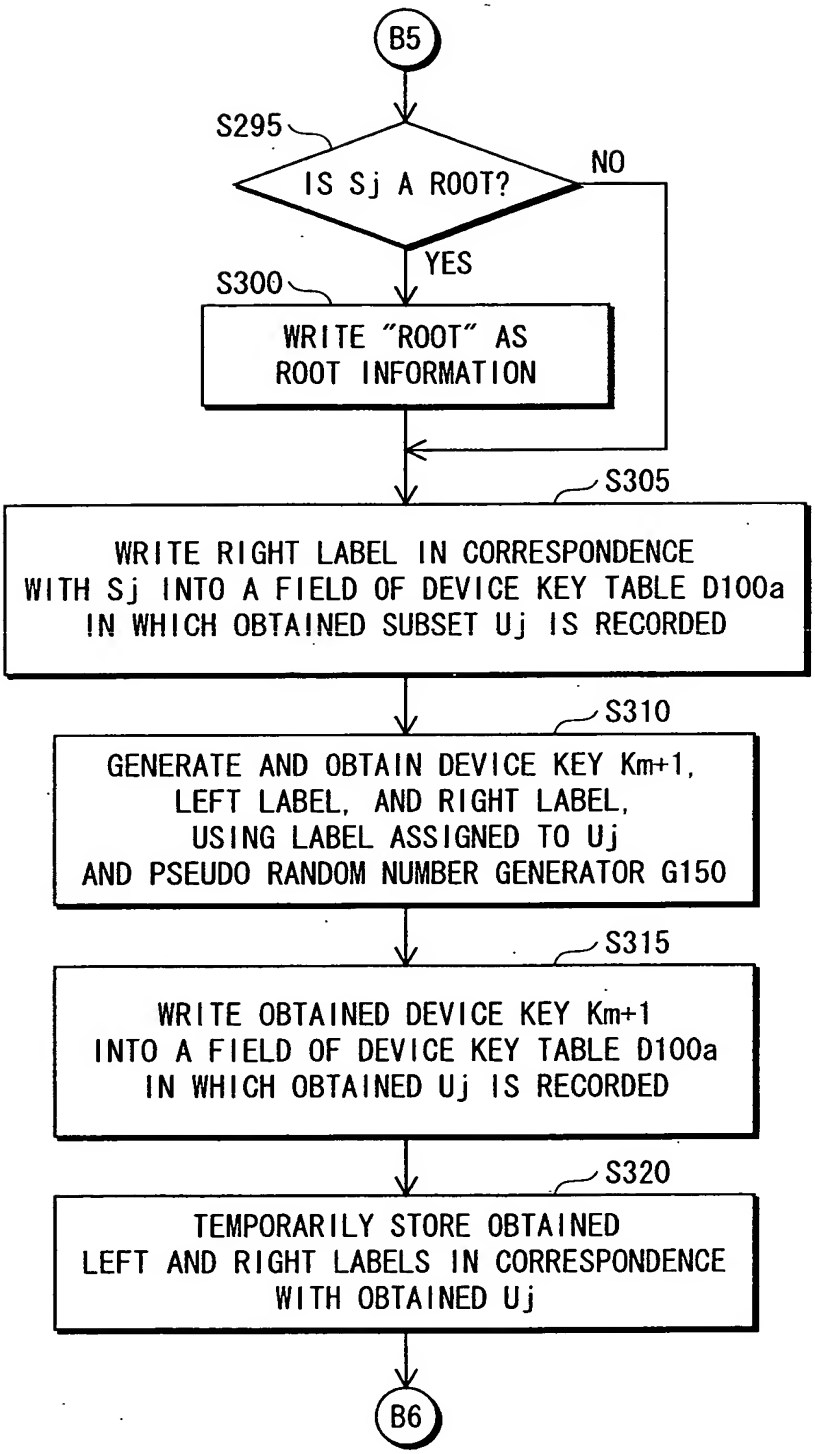

B5
S295
IS Sj A ROOT?
NO
YES
S300
WRITE "ROOT" AS ROOT INFORMATION
S305
WRITE RIGHT LABEL IN CORRESPONDENCE WITH Sj INTO A FIELD OF DEVICE KEY TABLE D100a IN WHICH OBTAINED SUBSET Uj IS RECORDED
S310
GENERATE AND OBTAIN DEVICE KEY Km+1, LEFT LABEL, AND RIGHT LABEL, USING LABEL ASSIGNED TO Uj AND PSEUDO RANDOM NUMBER GENERATOR G150
S315
WRITE OBTAINED DEVICE KEY Km+1 INTO A FIELD OF DEVICE KEY TABLE D100a IN WHICH OBTAINED Uj IS RECORDED
S320
TEMPORARILY STORE OBTAINED LEFT AND RIGHT LABELS IN CORRESPONDENCE WITH OBTAINED Uj
B6

FIG. 25

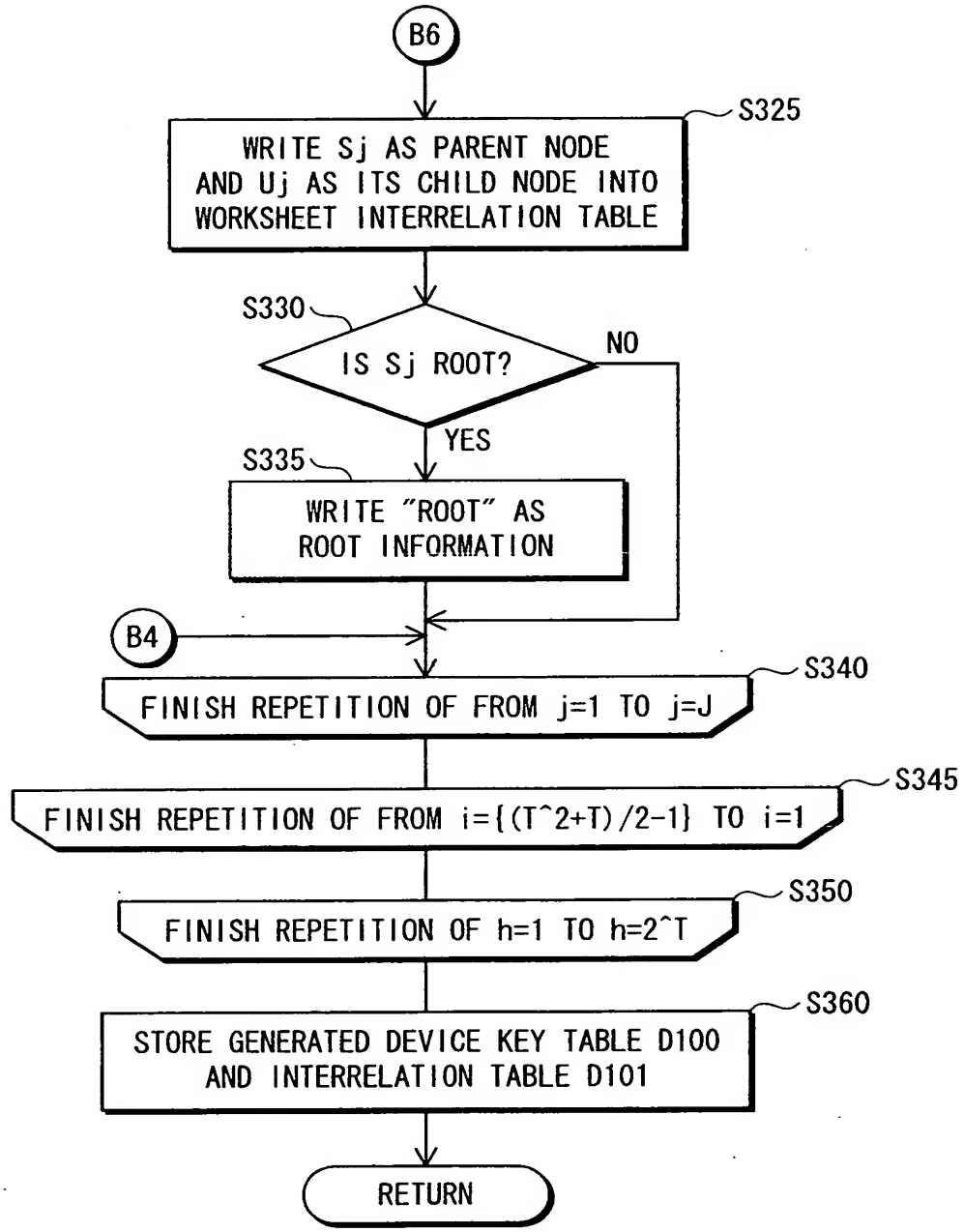

B6
S325
WRITE Sj AS PARENT NODE AND Uj AS ITS CHILD NODE INTO WORKSHEET INTERRELATION TABLE
S330
IS Sj ROOT?
NO
YES
S335
WRITE "ROOT" AS ROOT INFORMATION
B4
S340
FINISH REPETITION OF FROM j=1 TO j=J
S345
FINISH REPETITION OF FROM i={(T^2+T)/2-1} TO i=1
S350
FINISH REPETITION OF h=1 TO h=2^T
S360
STORE GENERATED DEVICE KEY TABLE D100 AND INTERRELATION TABLE D101
RETURN

FIG. 26

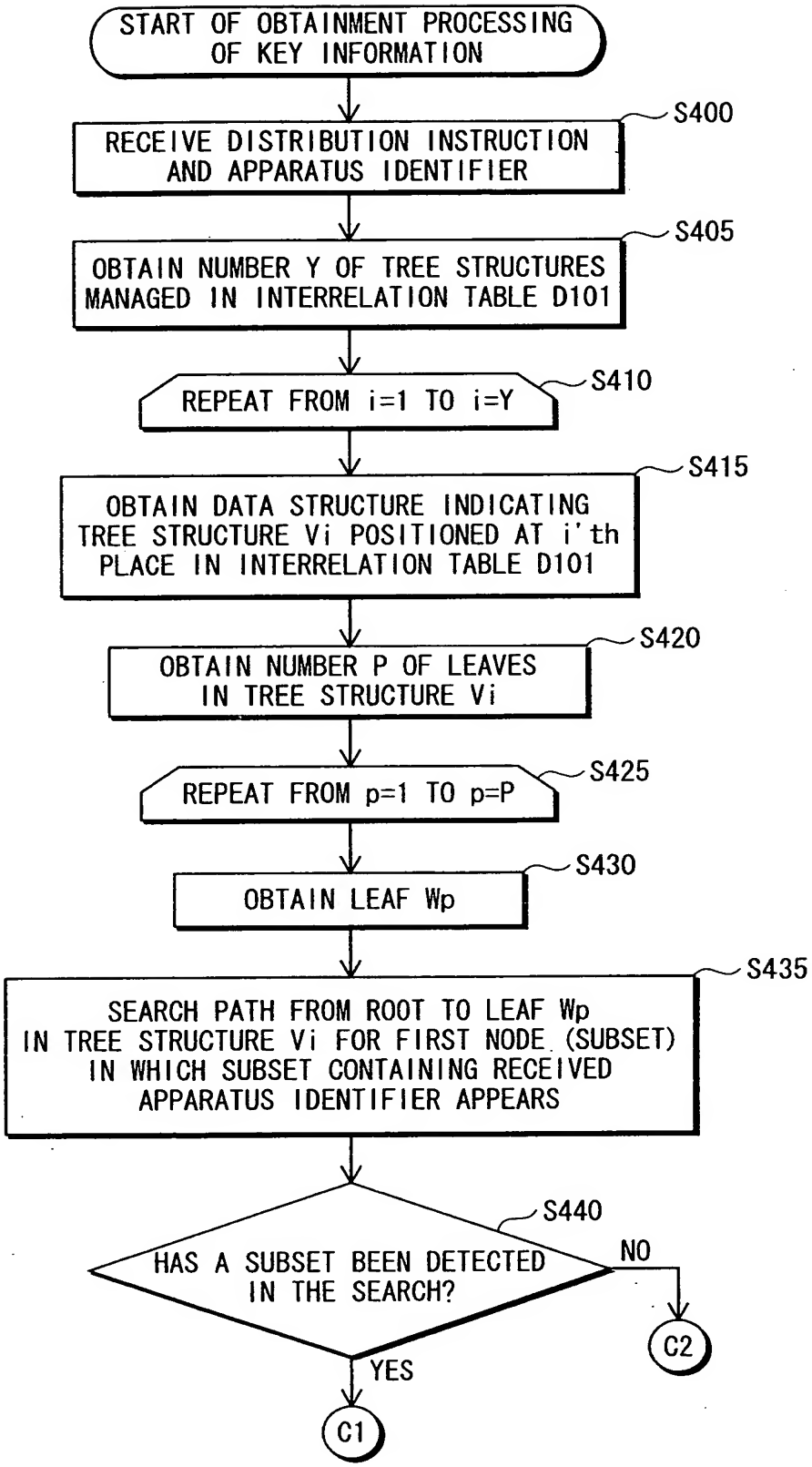

START OF OBTAINMENT PROCESSING OF KEY INFORMATION
S400
RECEIVE DISTRIBUTION INSTRUCTION AND APPARATUS IDENTIFIER
S405
OBTAIN NUMBER Y OF TREE STRUCTURES MANAGED IN INTERRELATION TABLE D101
S410
REPEAT FROM i=1 TO i=Y
S415
OBTAIN DATA STRUCTURE INDICATING TREE STRUCTURE Vi POSITIONED AT i'th PLACE IN INTERRELATION TABLE D101
S420
OBTAIN NUMBER P OF LEAVES IN TREE STRUCTURE Vi
S425
REPEAT FROM p=1 TO p=P
S430
OBTAIN LEAF Wp
S435
SEARCH PATH FROM ROOT TO LEAF Wp IN TREE STRUCTURE Vi FOR FIRST NODE (SUBSET) IN WHICH SUBSET CONTAINING RECEIVED APPARATUS IDENTIFIER APPEARS
S440
HAS A SUBSET BEEN DETECTED IN THE SEARCH?
NO
C2
YES
C1

FIG. 27

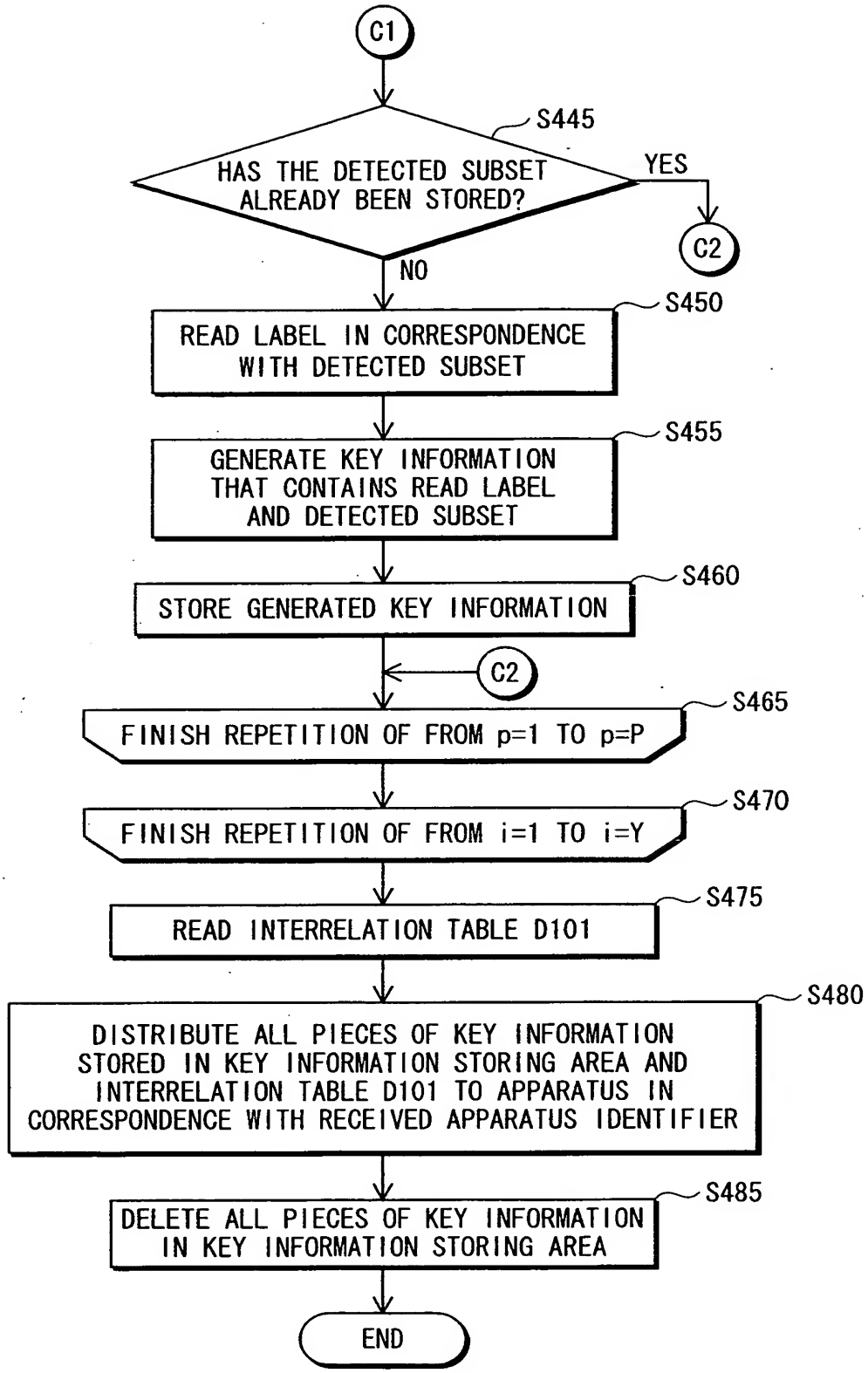

C1
S445
HAS THE DETECTED SUBSET ALREADY BEEN STORED?
YES
C2
NO
S450
READ LABEL IN CORRESPONDENCE WITH DETECTED SUBSET
S455
GENERATE KEY INFORMATION THAT CONTAINS READ LABEL AND DETECTED SUBSET
S460
STORE GENERATED KEY INFORMATION
C2
S465
FINISH REPETITION OF FROM p=1 TO p=P
S470
FINISH REPETITION OF FROM i=1 TO i=Y
S475
READ INTERRELATION TABLE D101
S480
DISTRIBUTE ALL PIECES OF KEY INFORMATION STORED IN KEY INFORMATION STORING AREA AND INTERRELATION TABLE D101 TO APPARATUS IN CORRESPONDENCE WITH RECEIVED APPARATUS IDENTIFIER
S485
DELETE ALL PIECES OF KEY INFORMATION IN KEY INFORMATION STORING AREA
END

FIG. 28

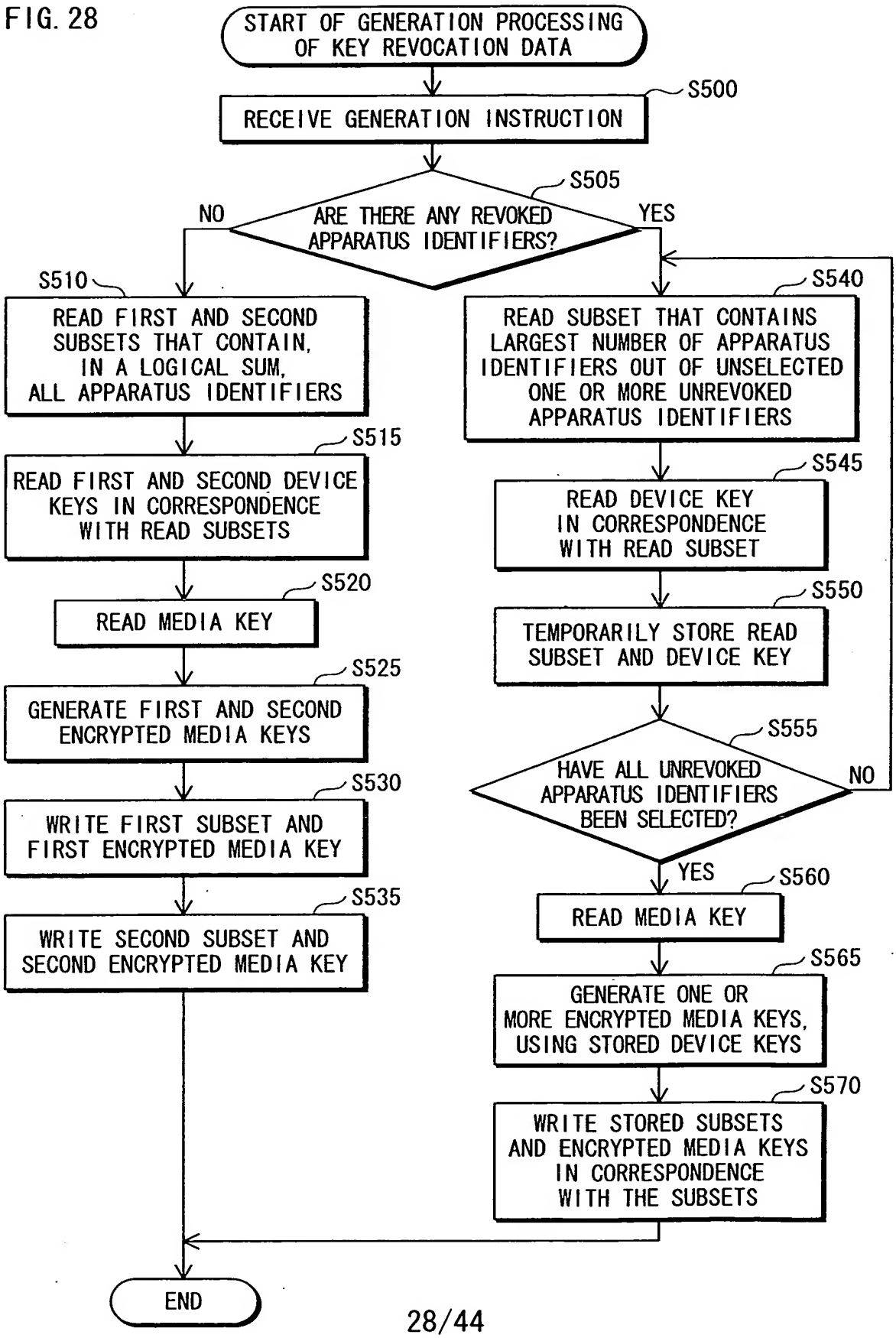

START OF GENERATION PROCESSING OF KEY REVOCATION DATA
RECEIVE GENERATION INSTRUCTION
S500
ARE THERE ANY REVOKED APPARATUS IDENTIFIERS?
S505
NO
YES
READ FIRST AND SECOND SUBSETS THAT CONTAIN, IN A LOGICAL SUM, ALL APPARATUS IDENTIFIERS
S510
READ FIRST AND SECOND DEVICE KEYS IN CORRESPONDENCE WITH READ SUBSETS
S515
READ MEDIA KEY
S520
GENERATE FIRST AND SECOND ENCRYPTED MEDIA KEYS
S525
WRITE FIRST SUBSET AND FIRST ENCRYPTED MEDIA KEY
S530
WRITE SECOND SUBSET AND SECOND ENCRYPTED MEDIA KEY
S535
READ SUBSET THAT CONTAINS LARGEST NUMBER OF APPARATUS IDENTIFIERS OUT OF UNSELECTED ONE OR MORE UNREVOKED APPARATUS IDENTIFIERS
S540
READ DEVICE KEY IN CORRESPONDENCE WITH READ SUBSET
S545
TEMPORARILY STORE READ SUBSET AND DEVICE KEY
S550
HAVE ALL UNREVOKED APPARATUS IDENTIFIERS BEEN SELECTED?
S555
NO
YES
READ MEDIA KEY
S560
GENERATE ONE OR MORE ENCRYPTED MEDIA KEYS, USING STORED DEVICE KEYS
S565
WRITE STORED SUBSETS AND ENCRYPTED MEDIA KEYS IN CORRESPONDENCE WITH THE SUBSETS
S570
END

FIG. 29

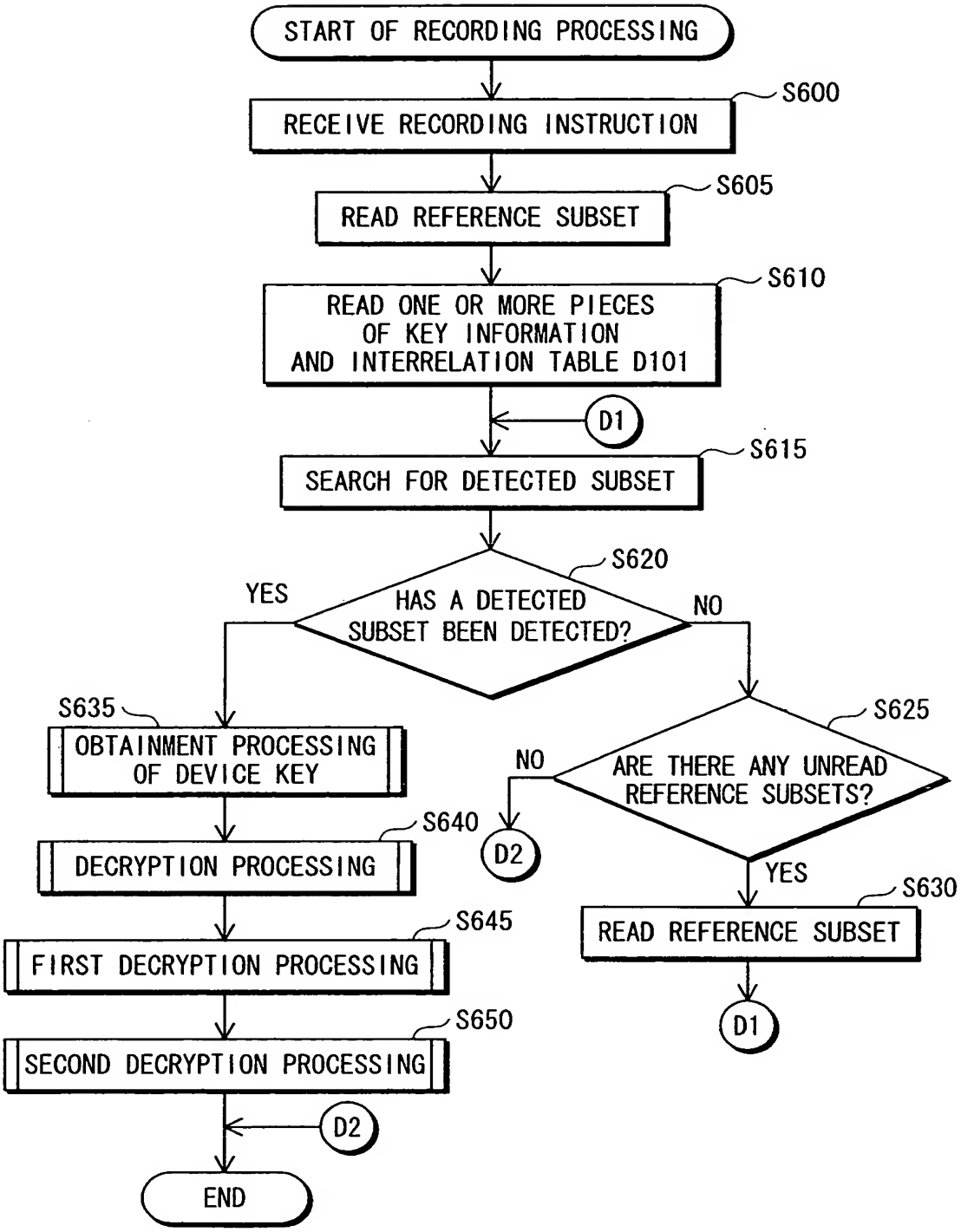

START OF RECORDING PROCESSING
S600
RECEIVE RECORDING INSTRUCTION
S605
READ REFERENCE SUBSET
S610
READ ONE OR MORE PIECES OF KEY INFORMATION AND INTERRELATION TABLE D101
D1
S615
SEARCH FOR DETECTED SUBSET
S620
HAS A DETECTED SUBSET BEEN DETECTED?
YES
NO
S635
OBTAINMENT PROCESSING OF DEVICE KEY
S640
DECRYPTION PROCESSING
S645
FIRST DECRYPTION PROCESSING
S650
SECOND DECRYPTION PROCESSING
D2
END
S625
ARE THERE ANY UNREAD REFERENCE SUBSETS?
NO
D2
YES
S630
READ REFERENCE SUBSET
D1

FIG. 30

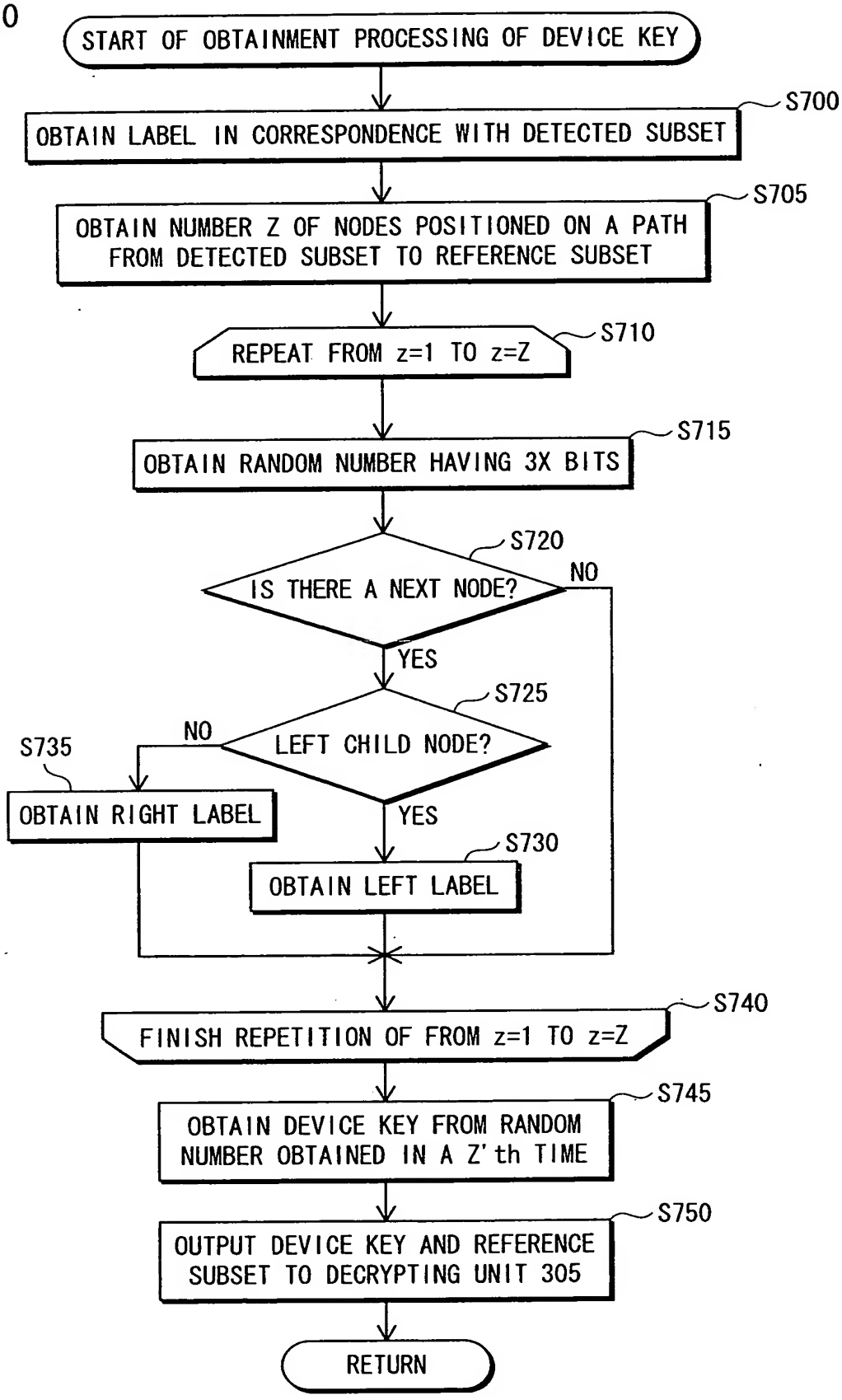

START OF OBTAINMENT PROCESSING OF DEVICE KEY
S700
OBTAIN LABEL IN CORRESPONDENCE WITH DETECTED SUBSET
S705
OBTAIN NUMBER Z OF NODES POSITIONED ON A PATH FROM DETECTED SUBSET TO REFERENCE SUBSET
S710
REPEAT FROM z=1 TO z=Z
S715
OBTAIN RANDOM NUMBER HAVING 3X BITS
S720
IS THERE A NEXT NODE?
NO
YES
S725
LEFT CHILD NODE?
NO
S735
OBTAIN RIGHT LABEL
YES
S730
OBTAIN LEFT LABEL
S740
FINISH REPETITION OF FROM z=1 TO z=Z
S745
OBTAIN DEVICE KEY FROM RANDOM NUMBER OBTAINED IN A Z'th TIME
S750
OUTPUT DEVICE KEY AND REFERENCE SUBSET TO DECRYPTING UNIT 305
RETURN

FIG. 31

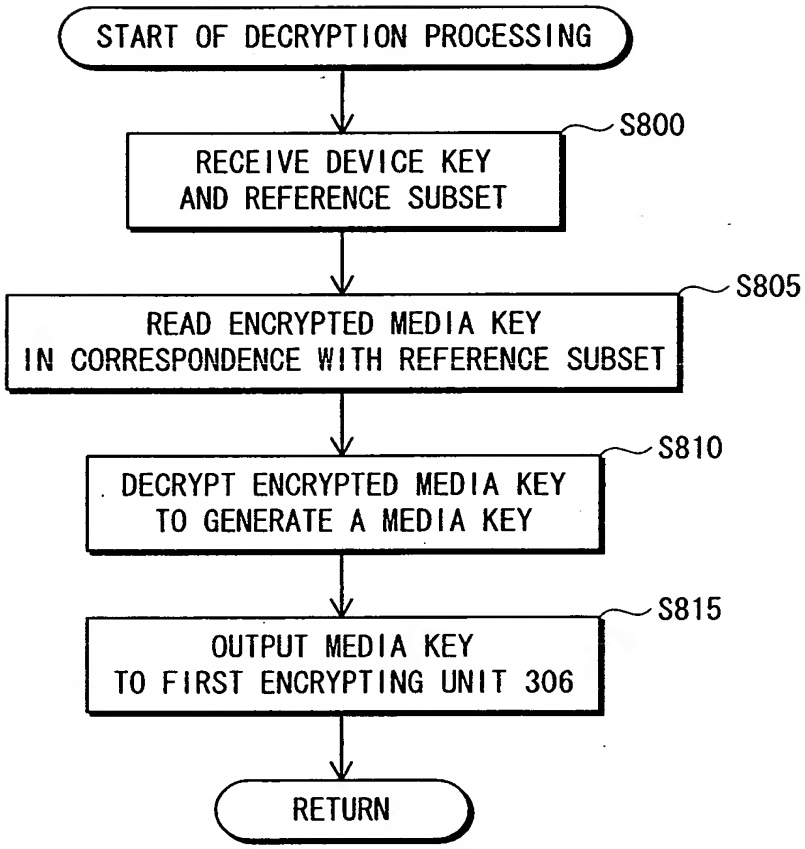

START OF DECRYPTION PROCESSING
S800
RECEIVE DEVICE KEY AND REFERENCE SUBSET
S805
READ ENCRYPTED MEDIA KEY IN CORRESPONDENCE WITH REFERENCE SUBSET
S810
DECRYPT ENCRYPTED MEDIA KEY TO GENERATE A MEDIA KEY
S815
OUTPUT MEDIA KEY TO FIRST ENCRYPTING UNIT 306
RETURN

FIG. 32

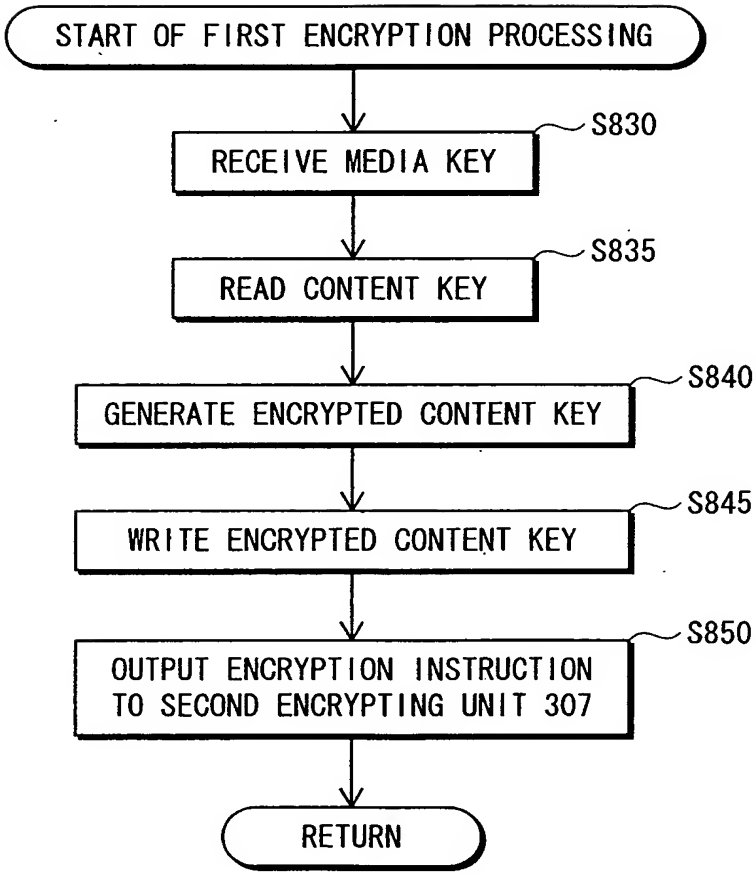

START OF FIRST ENCRYPTION PROCESSING
S830
RECEIVE MEDIA KEY
S835
READ CONTENT KEY
S840
GENERATE ENCRYPTED CONTENT KEY
S845
WRITE ENCRYPTED CONTENT KEY
S850
OUTPUT ENCRYPTION INSTRUCTION TO SECOND ENCRYPTING UNIT 307
RETURN

FIG. 33

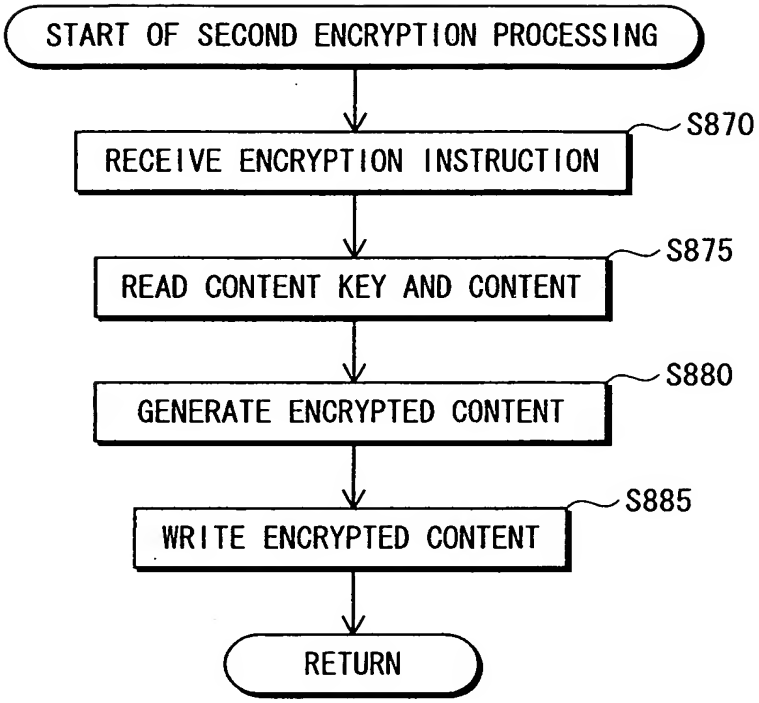

START OF SECOND ENCRYPTION PROCESSING
S870
RECEIVE ENCRYPTION INSTRUCTION
S875
READ CONTENT KEY AND CONTENT
S880
GENERATE ENCRYPTED CONTENT
S885
WRITE ENCRYPTED CONTENT
RETURN

FIG. 34

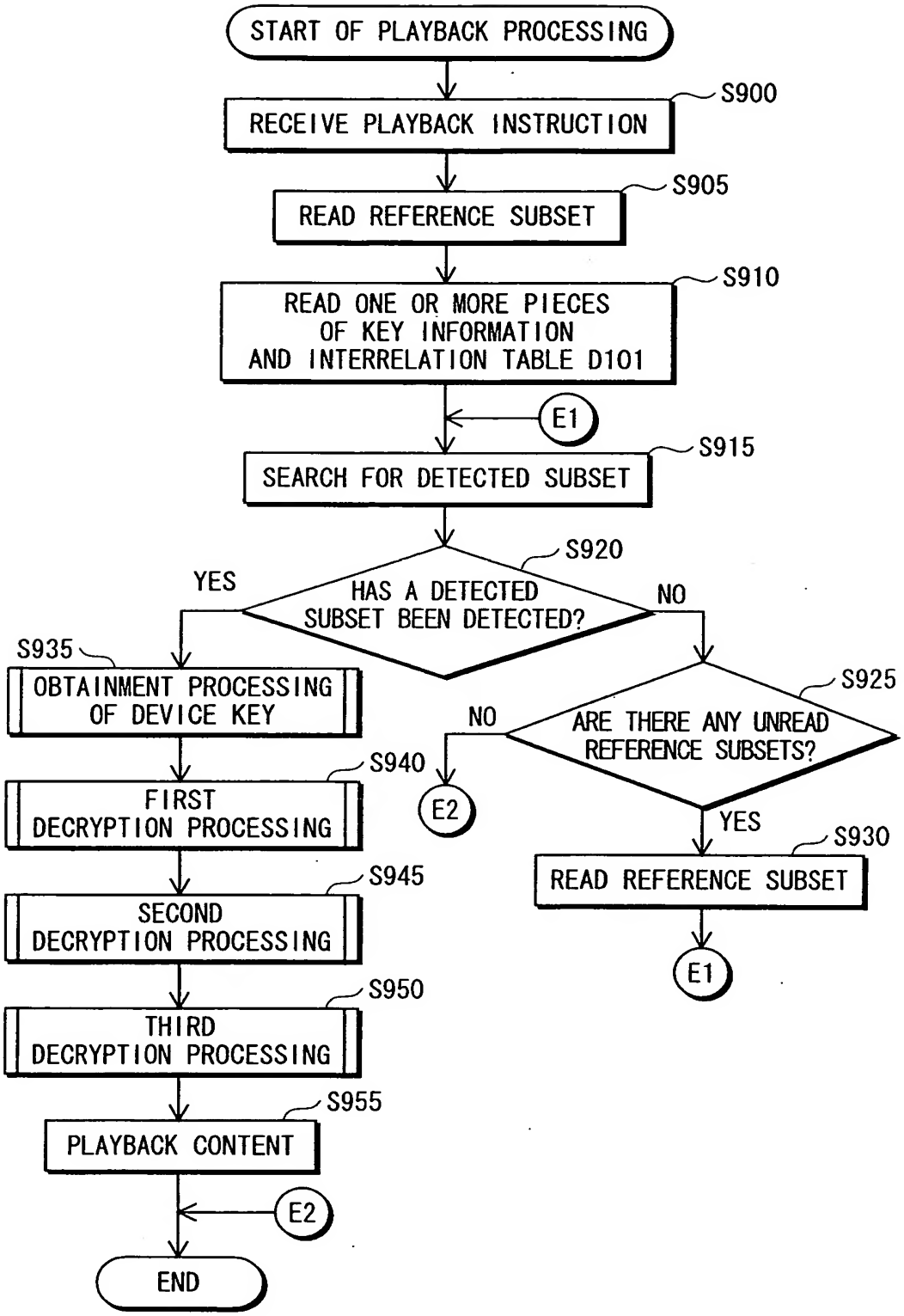

START OF PLAYBACK PROCESSING
S900
RECEIVE PLAYBACK INSTRUCTION
S905
READ REFERENCE SUBSET
S910
READ ONE OR MORE PIECES OF KEY INFORMATION AND INTERRELATION TABLE D101
E1
S915
SEARCH FOR DETECTED SUBSET
S920
HAS A DETECTED SUBSET BEEN DETECTED?
YES
NO
S935
OBTAINMENT PROCESSING OF DEVICE KEY
S940
FIRST DECRYPTION PROCESSING
S945
SECOND DECRYPTION PROCESSING
S950
THIRD DECRYPTION PROCESSING
S955
PLAYBACK CONTENT
E2
END
S925
ARE THERE ANY UNREAD REFERENCE SUBSETS?
NO
E2
YES
S930
READ REFERENCE SUBSET
E1

FIG. 35

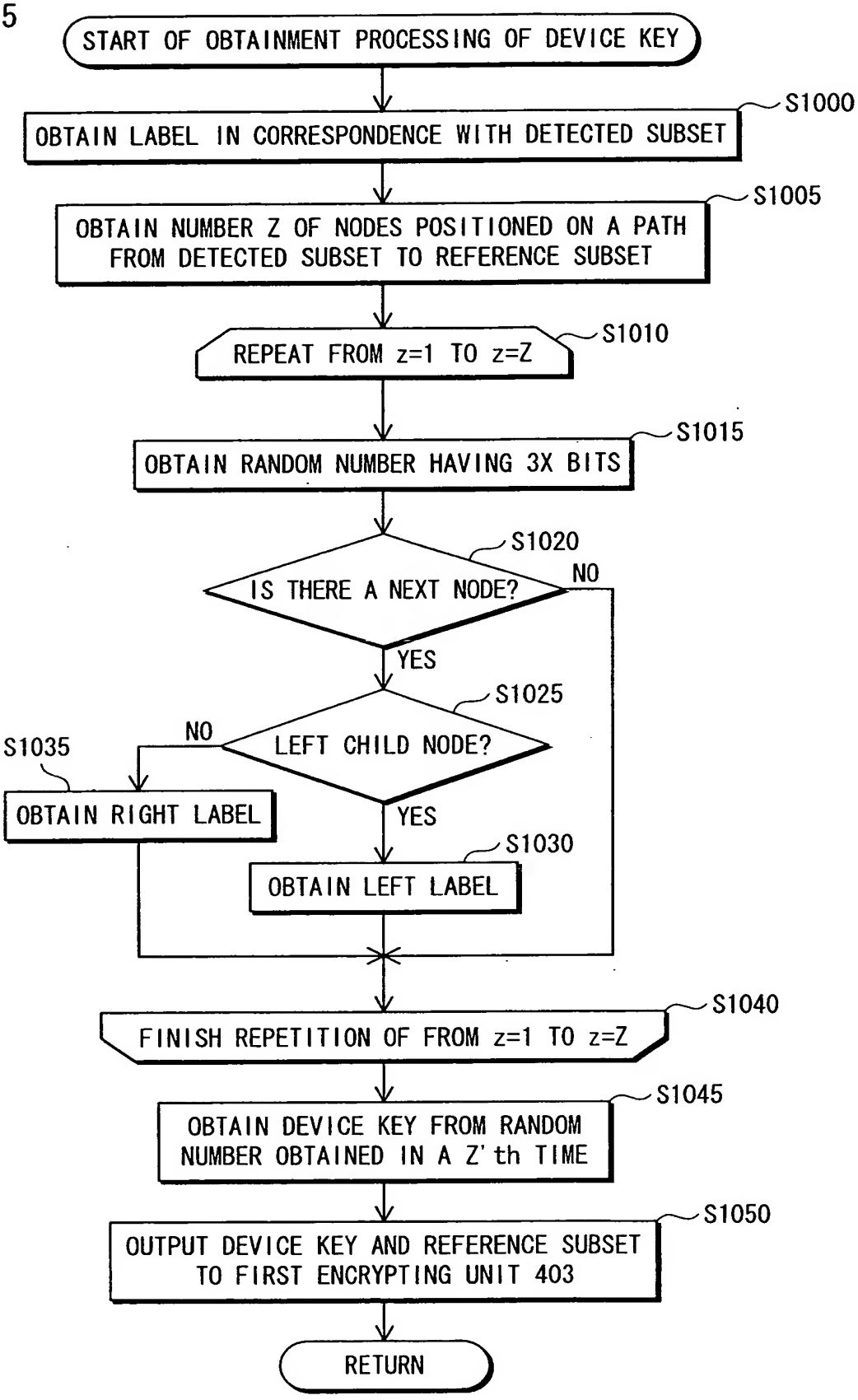

START OF OBTAINMENT PROCESSING OF DEVICE KEY
S1000
OBTAIN LABEL IN CORRESPONDENCE WITH DETECTED SUBSET
S1005
OBTAIN NUMBER Z OF NODES POSITIONED ON A PATH FROM DETECTED SUBSET TO REFERENCE SUBSET
S1010
REPEAT FROM z=1 TO z=Z
S1015
OBTAIN RANDOM NUMBER HAVING 3X BITS
S1020
IS THERE A NEXT NODE?
NO
YES
S1025
LEFT CHILD NODE?
NO
S1035
OBTAIN RIGHT LABEL
YES
S1030
OBTAIN LEFT LABEL
S1040
FINISH REPETITION OF FROM z=1 TO z=Z
S1045
OBTAIN DEVICE KEY FROM RANDOM NUMBER OBTAINED IN A Z' th TIME
S1050
OUTPUT DEVICE KEY AND REFERENCE SUBSET TO FIRST ENCRYPTING UNIT 403
RETURN

FIG. 36

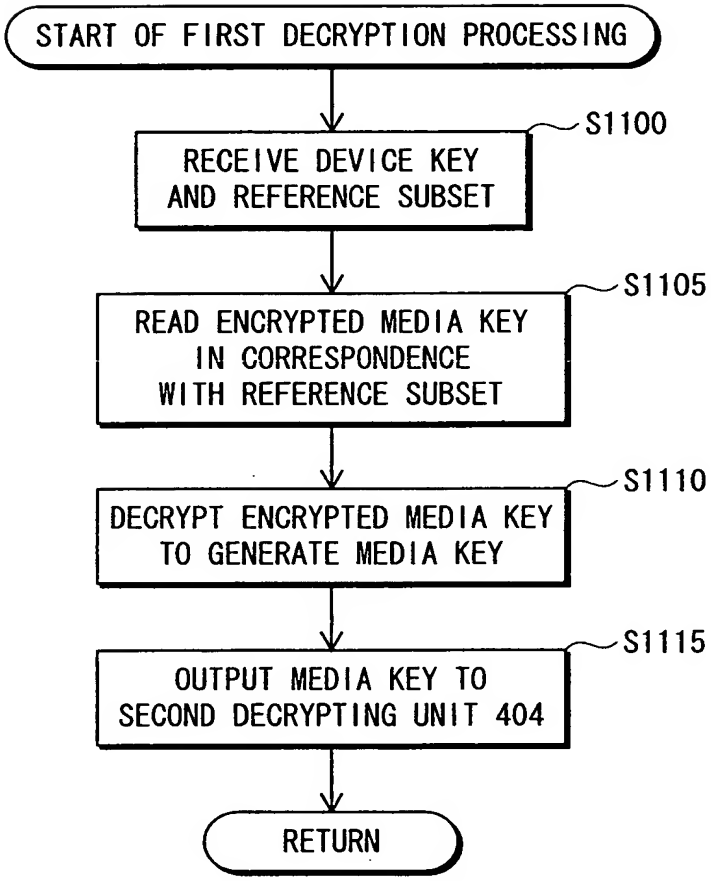

START OF FIRST DECRYPTION PROCESSING
S1100
RECEIVE DEVICE KEY AND REFERENCE SUBSET
S1105
READ ENCRYPTED MEDIA KEY IN CORRESPONDENCE WITH REFERENCE SUBSET
S1110
DECRYPT ENCRYPTED MEDIA KEY TO GENERATE MEDIA KEY
S1115
OUTPUT MEDIA KEY TO SECOND DECRYPTING UNIT 404
RETURN

FIG. 37

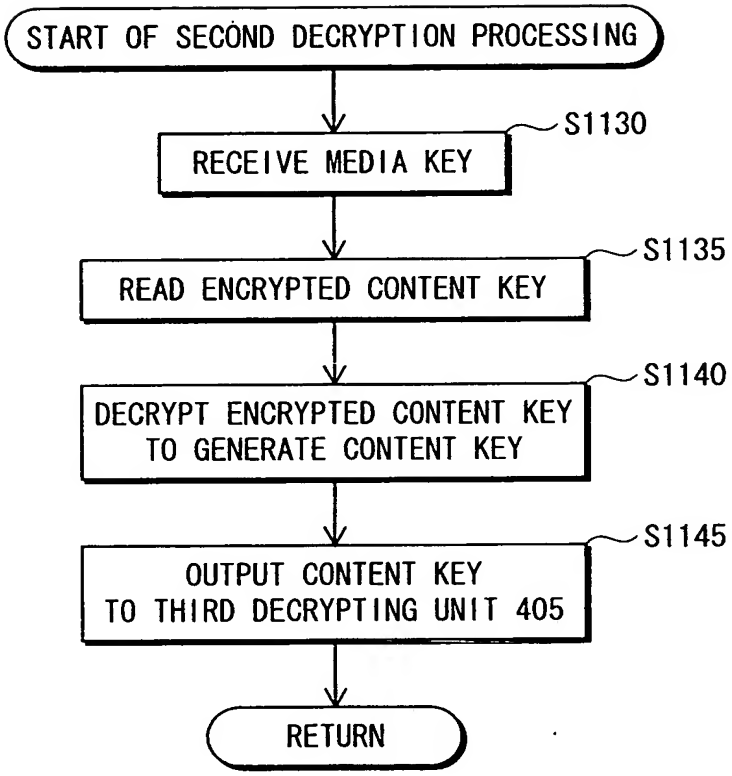

START OF SECOND DECRYPTION PROCESSING
S1130
RECEIVE MEDIA KEY
S1135
READ ENCRYPTED CONTENT KEY
S1140
DECRYPT ENCRYPTED CONTENT KEY TO GENERATE CONTENT KEY
S1145
OUTPUT CONTENT KEY TO THIRD DECRYPTING UNIT 405
RETURN

FIG. 38

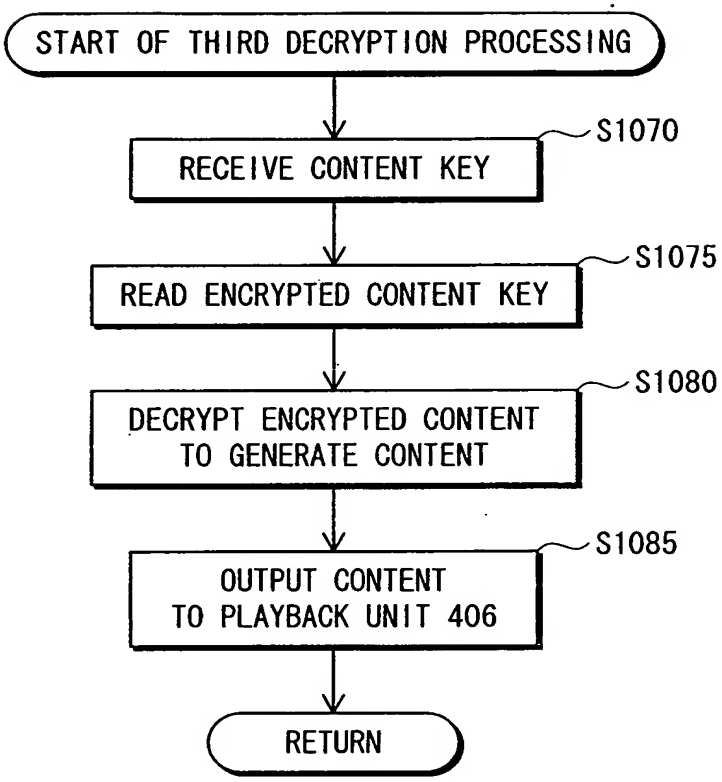

START OF THIRD DECRYPTION PROCESSING
S1070
RECEIVE CONTENT KEY
S1075
READ ENCRYPTED CONTENT KEY
S1080
DECRYPT ENCRYPTED CONTENT TO GENERATE CONTENT
S1085
OUTPUT CONTENT TO PLAYBACK UNIT 406
RETURN

FIG. 39

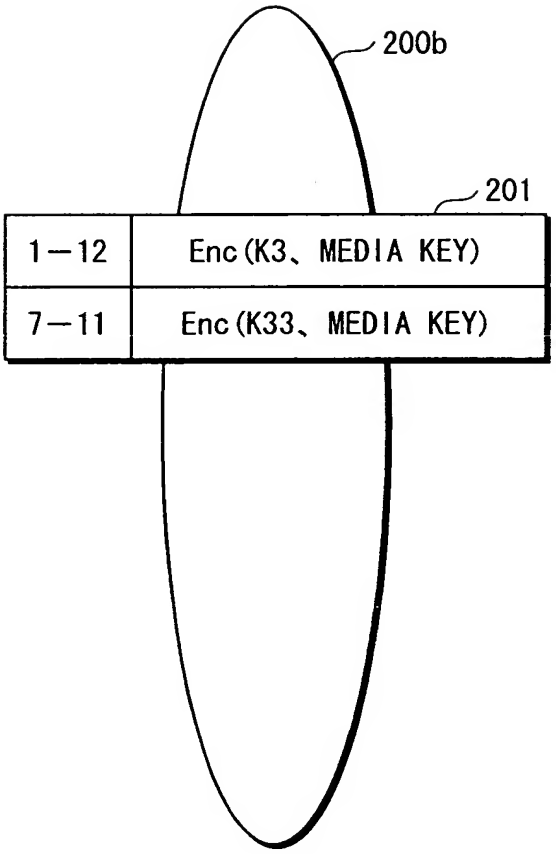


FIG. 40

APPARATUS NAME	TOTAL NUMBER OF PIECES	KEY INFORMATION STORED IN THE APPARATUS					
APPARATUS 1	4 PIECES (−2)	1−0 A1	3−12 A3RL	5−1212 A5RLRL	5−12112 A5RLRRL		
APPARATUS 2	5 PIECES (−1)	2−0 A2	1−1 A1R	3−11 A3RR	5−1212 A5RLRL	5−12111 A5RLRRR	
APPARATUS 3	4 PIECES (−2)	3−0 A3	1−12 A1RL	5−1211 A5RLRR	5−12122 A5RLRLL		
APPARATUS 4	6 PIECES (0)	4−0 A4	3−1 A3R	1−11 A1RR	1−121 A1RLR	5−1211 A5RLRR	5−12121 A5RLRLR
APPARATUS 5	4 PIECES (−2)	5−0 A5	7−12 A7RL	1−1212 A1RLRL	1−12112 A1RLRRL		
APPARATUS 6	5 PIECES (−1)	6−0 A6	5−1 A5R	7−11 A7RR	1−1212 A1RLRL	1−12111 A1RLRRR	
APPARATUS 7	4 PIECES (−2)	7−0 A7	5−12 A5RL	1−1211 A1RLRR	1−12122 A1RLRLL		
APPARATUS 8	6 PIECES (0)	8−0 A8	7−1 A7R	5−11 A5RR	5−121 A5RLR	1−1211 A1RLRR	1−12121 A1RLRLR

FIG. 41

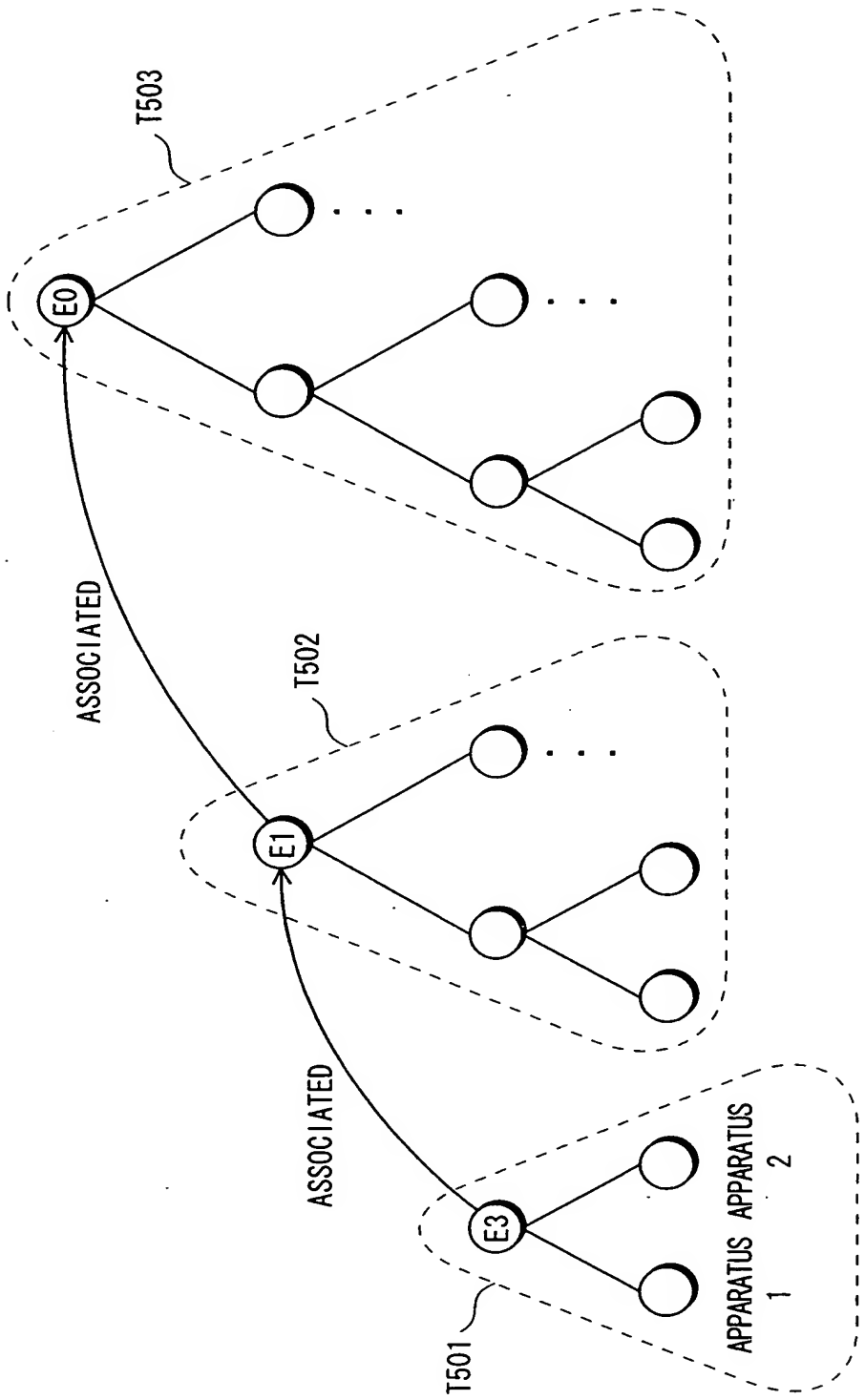

T503
E0
ASSOCIATED
T502
E1
ASSOCIATED
E3
APPARATUS 1
APPARATUS 2
T501

FIG. 42

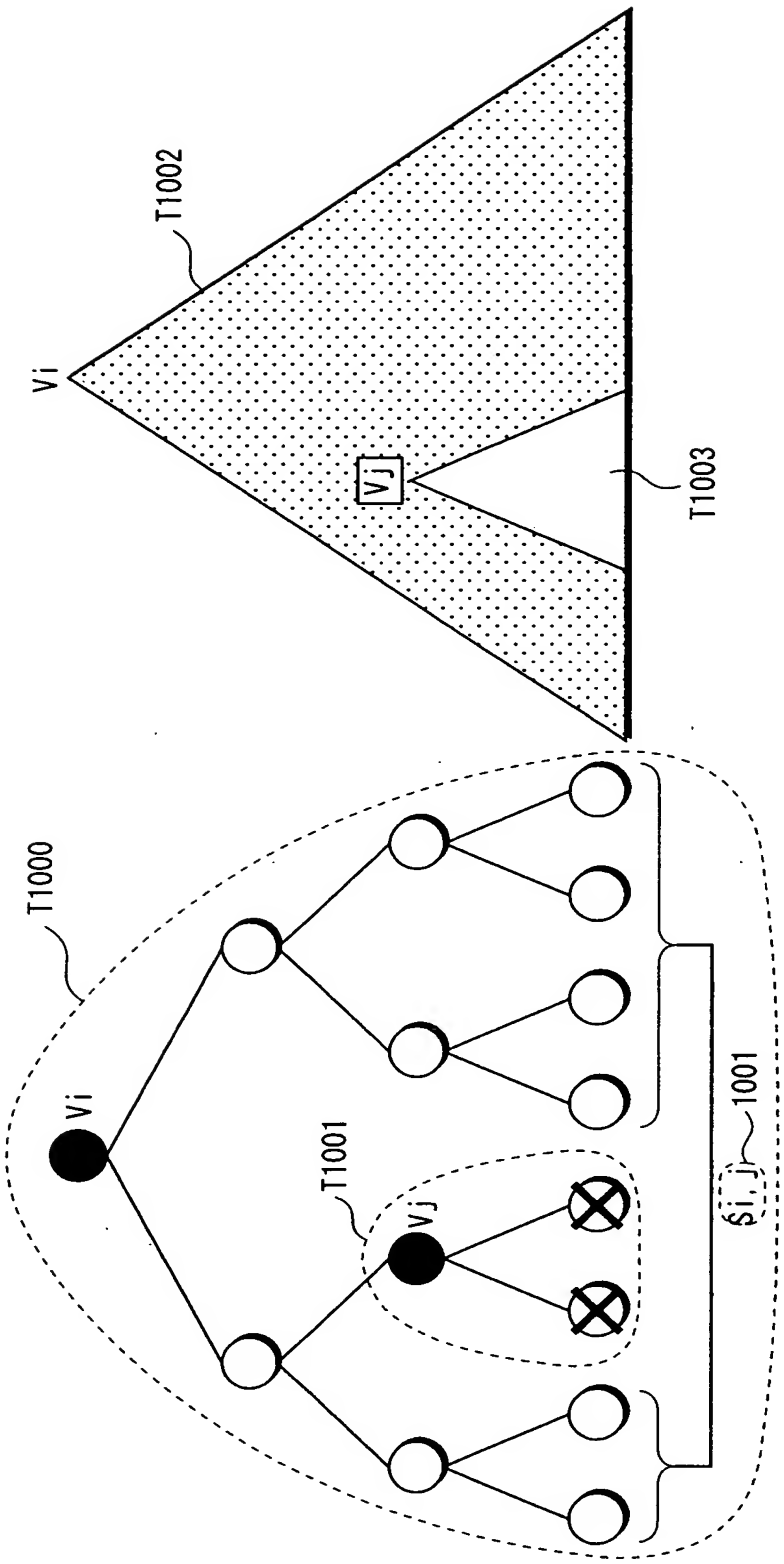


FIG. 43

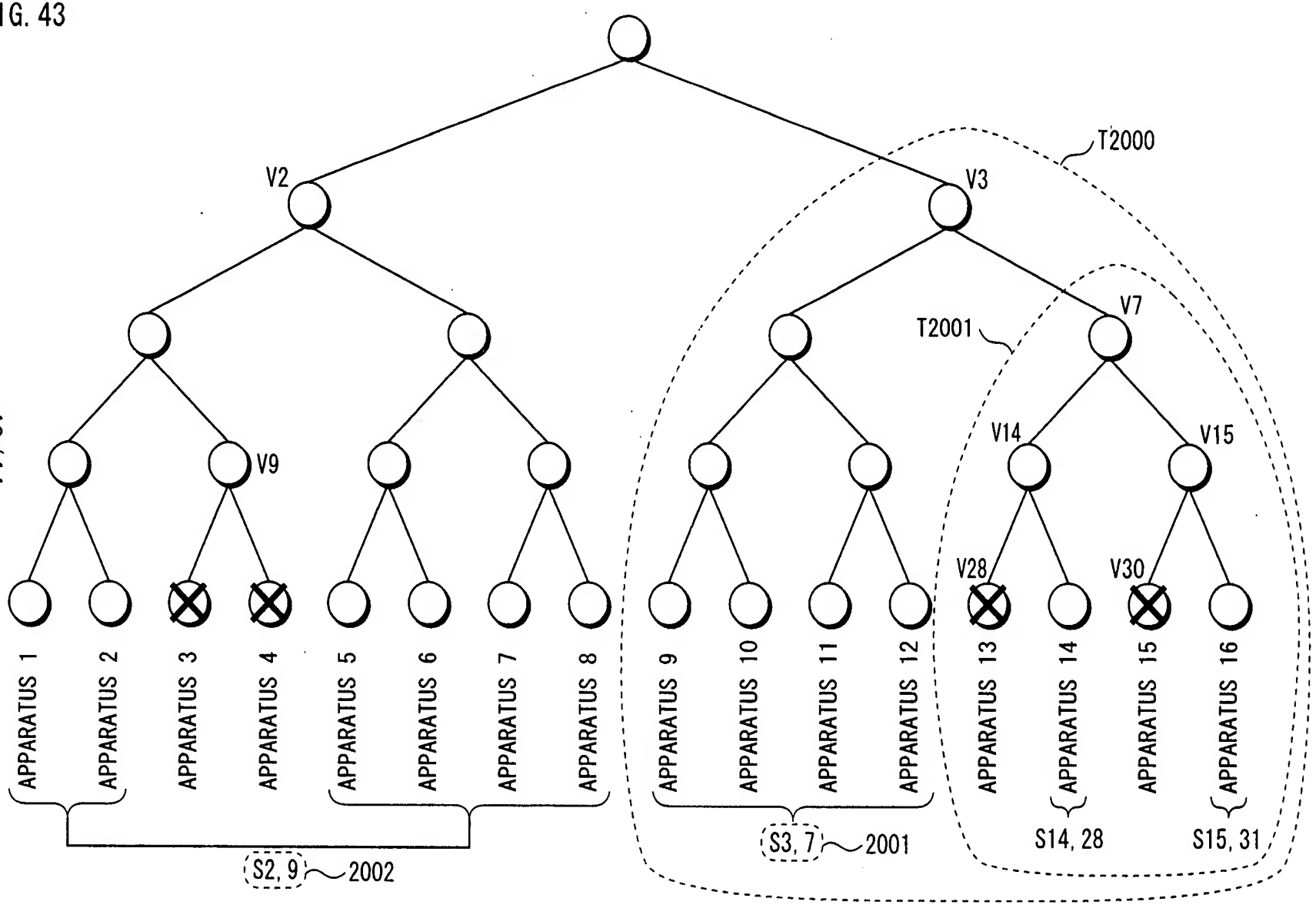
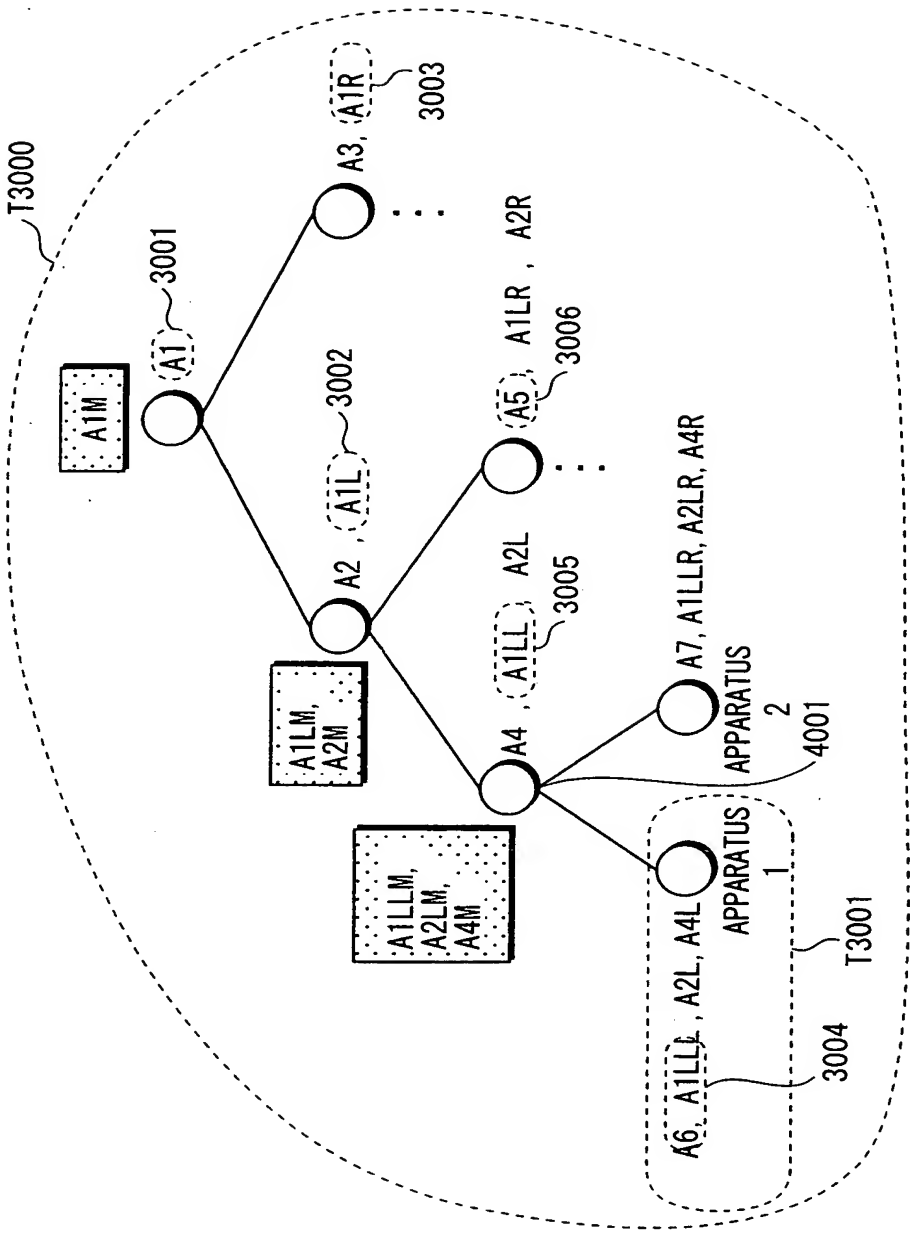

T2000
V2
V3
T2001
V7
V9
V14
V15
V28
V30
APPARATUS 1
APPARATUS 2
APPARATUS 3
APPARATUS 4
APPARATUS 5
APPARATUS 6
APPARATUS 7
APPARATUS 8
APPARATUS 9
APPARATUS 10
APPARATUS 11
APPARATUS 12
APPARATUS 13
APPARATUS 14
APPARATUS 15
APPARATUS 16
S2, 9
2002
S3, 7
2001
S14, 28
S15, 31

FIG. 44


T3000
A1M
A1
3001
A1LM,
A2M
A2
A1L
3002
A3, A1R
3003
A1LLM,
A2LM,
A4M
A4
A1LL
A2L
3005
A5
A1LR , A2R
3006
A7, A1LLR, A2LR, A4R
APPARATUS
2
4001
A6, A1LL , A2L, A4L
APPARATUS
1
T3001
3004